



The Printer Working Group

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IPP System Service v1.0 (SYSTEM)

Status: Prototype

Abstract: This document defines an IPP binding of the PWG Semantic Model root System object and associated System Control Service that are defined in (PWG 5108.06), the PWG Resource Service that is defined in (PWG 5108.03), and an IPP operation to support registration as defined in the PWG Cloud Imaging Requirements and Model (PWG 5109.1).

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1. Introduction

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 [PWG5108.06] and the PWG Resource Service that is defined in [PWG5108.03]. This document defines IPP objects, operations, and attributes to support management and status monitoring of all configured Services, Subunits, and Resources on an Imaging System. 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 [PWG5109.1] and concrete IPP Shared Infrastructure Extensions [PWG5100.18].

1.1 Rationale for Two IPP Protocol Endpoints

This document defines the IPP System object that represents the IPP System Service. The IPP operations on this System object and the IPP attributes defined for this System object are disjoint from those defined for the Printer object in [RFC8011]. An IPP Imaging System that conforms to this document supports both an IPP System object and (via a System response to the Get-Printers operation) zero or more IPP Printer objects, each of which has a separate IPP Protocol Endpoint – i.e., separate values of IPP URI [RFC3510] or IPPS URI [RFC7472].

1.2 Get-Printer-Attributes Extension

For the convenience of existing IPP Clients, this document also includes the original Get-Printer-Attributes operation defined in IPP/1.1 Model and Semantics [RFC8011] with an extension to automatically select the implementation-defined or site-defined “default” IPP Printer object, unless the IPP Client explicitly specifies a given target Printer object in the Get-Printer-Attributes request.

1.3 Printer Identifier Extension

This document defines a new IPP attribute “printer-id” that contains an integer unique identifier for each Printer object within the IPP Imaging System. This extension simplifies references to Printer objects, each of which can potentially support multiple Protocol Endpoints in “printer-xri-supported” with different Client authentication and Printer security policies. The use of a “printer-uri” operation attribute to identify a Printer object therefore has some ambiguity about available operations and attributes via a specific Protocol Endpoint.

2. Terminology

2.1 Conformance Terminology

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

2.2 Protocol Role Terminology

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

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

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

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

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

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

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

Proxy: A Client that sends configuration and status information to and retrieves and manages Jobs and Documents from an Infrastructure Printer [PWG5100.18] on behalf of one or more Output Devices and also communicates internally with an Infrastructure System to register the local System and get back Infrastructure Printer URIs.

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

424 **2.3 Printing Terminology**

425 Normative definitions and semantics of printing terms are imported from IETF Design Goals
426 for an Internet Printing Protocol [RFC2567], IETF Printer MIB v2 [RFC3805], IETF Printer
427 Finishing MIB [RFC3806], IETF Internet Printing Protocol: Event Notifications and
428 Subscriptions [RFC3995], PWG IPP FaxOut Service [PWG5100.15], PWG IPP Scan
429 Service [PWG5100.17], PWG IPP Shared Infrastructure Extensions (INFRA)
430 [PWG5100.18], PWG MFD Model and Common Semantics [PWG5108.01], PWG Network
431 Resource Service Semantic Model and Service Interface [PWG5108.03], PWG System
432 Object and System Control Service Semantics [PWG5108.06], and IETF Internet Printing
433 Protocol/1.1: Model and Semantics [RFC8011].

434 *Administrator*: An End User who is also authorized to manage all aspects of an Output
435 Device or Printer, including creating the printer instances and controlling the authorization
436 of other End Users and Operators [RFC2567].

437 *Delivery Method*: The mechanism by which a System or Printer delivers an Event
438 Notification [RFC3995].

439 *Document*: An object created and managed by an Imaging Service that contains the
440 description, processing, and status information. A Document object may have attached data
441 and is bound to a single Job object [RFC8011].

442 *End User*: A person or software process that is authorized to perform basic printing
443 functions, including finding/locating a printer, creating a local instance of a printer, viewing
444 printer status, viewing printer capabilities, submitting a print job, viewing print job status, and
445 altering the attributes of a print job [RFC2567].

446 *Event*: An occurrence (either expected or unexpected) within a System of a change of state,
447 condition, or configuration of a System, Printer, or Job. An Event occurs only at one instant
448 in time and does not span the time the physical Event takes place [RFC3995].

449 *Event Notification*: The information about an Event that the Printer delivers when an Event
450 occurs [RFC3995].

451 *FaxOut Job*: An object created and managed by a FaxOut Service that contains description,
452 processing, and status information. The FaxOut Job also contains zero or more Document
453 objects [PWG5100.15].

454 *FaxOut Service*: An Imaging Service that accepts incoming IPP operation requests for
455 creation of FaxOut Jobs and management of FaxOut Jobs and the service itself
456 [PWG5100.15].

- 457 *IPP Binding*: The Internet Printing Protocol implementation of an abstract information model
458 and associated set of abstract operations and data elements [RFC8011].
- 459 *Imaging Device*: A physical hardware entity (stand-alone) or logical software entity (hosted
460 on a network server) that supports one or more Imaging Services (e.g., Print, Scan, FaxOut,
461 etc.) [PWG5108.01].
- 462 *Imaging Service*: A software entity that supports document or image processing (e.g., Print,
463 Scan, FaxOut, etc.) [PWG5108.01].
- 464 *Imaging System*: A logical or physical system supports a System object and a System
465 Service for monitoring and management of one or more Imaging Services (e.g., Print, Scan,
466 FaxOut, etc.) [PWG5108.01].
- 467 *ith*: Referring to a specific IPP ‘1setOf’ value - the first value, the second value, and so forth.
- 468 *Job*: An object created and managed by an Imaging Service that contains the description,
469 processing, and status information. A Job object also contains zero or more Document
470 objects [RFC8011].
- 471 *Logical Device*: a print server, software service, or gateway that processes jobs and either
472 forwards or stores the processed job or uses one or more Physical Devices to render output
473 [RFC8011].
- 474 *Notification*: Synonym for Event Notification [RFC3995].
- 475 *Operator*: An End User that also has special rights on the Output Device or Printer. The
476 Operator typically monitors the status of the Printer and manages and controls the Jobs at
477 the Output Device [RFC2567]. The Operator is allowed to query and control the Printer,
478 Jobs, and Documents based on site policy.
- 479 *Output Device*: a single Logical or Physical Device [PWG5100.18].
- 480 *Owner*: The End User or Administrator who owns and manages (and typically created) a
481 Job, Printer, Resource, Subscription, or System [PWG5108.06].
- 482 *Physical Device*: a hardware implementation of an endpoint device, e.g., a marking engine,
483 a fax modem, etc [RFC8011].
- 484 *Print Job*: An object created and managed by a Print Service that contains description,
485 processing, and status information. The Print Job also contains zero or more Document
486 objects [RFC8011].
- 487 *Print Service*: An Imaging Service that accepts incoming IPP operation requests for creation
488 of Print Jobs and management of Print Jobs and the service itself [PWG5108.01].
- 489 *Printer*: Synonym for Imaging Service – an object that accepts incoming IPP operation
490 requests for creation of Imaging Jobs and management of Imaging Jobs [RFC8011].

491 *Resource:* A data object (e.g., firmware, font, logo, etc.) that can be configured on an
492 Imaging System for use by one or more Imaging Services and has a System, Printer, or Job
493 scope [PWG5108.01].

494 *Scan Job:* An object created and managed by a Scan Service that contains description,
495 processing, and status information. The Scan Job also contains zero or more Document
496 objects [PWG5100.17].

497 *Scan Service:* An Imaging Service that accepts incoming IPP operation requests for creation
498 of Scan Jobs and management of Scan Jobs and the service itself [PWG5100.17].

499 *Spooling Service:* An Imaging Service that stores all of a Job's document data so that it can
500 be reprocessed as needed [PWG5100.18].

501 *Streaming Service:* An Imaging Service that stores some of a Job's document data as it is
502 processed, output, and/or delivered [PWG5100.18].

503 *Subscription:* An object containing a set of attributes that indicate: the Notification Recipient
504 (for Push Delivery Method only), the Delivery Method, the Subscribed Events that cause the
505 Printer to deliver an Event Notification, and the information to include in an Event Notification
506 [RFC3995].

507 *Subunit:* A hardware component (e.g., input tray or marker) or software component (e.g.,
508 input channel or interpreter) of an Imaging System [RFC3995] [PWG5108.01].

509 *System Service:* A software entity that supports management of all hardware and software
510 components of an Imaging System and the System object defined in this specification
511 [PWG5108.06].

512 *Transform Job:* An object created and managed by a Transform Service that contains
513 description, processing, and status information. The Transform Job also contains zero or
514 more Document objects [PWG5108.01].

515 *Transform Service:* An Imaging Service that accepts incoming IPP operation requests for
516 creation of Transform Jobs and management of Transform Jobs and the service itself
517 [PWG5108.01].

518 **2.4 Abbreviations**

519 *DPA:* ISO Document Printing Application, <https://www.iso.org/standard/18191.html>

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

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

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

523 *PWG*: Printer Working Group, <http://www.pwg.org/>
524

3. Requirements for the IPP System Service

3.1 Rationale

Existing IPP specifications define the following features and functionality:

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

Existing PWG Semantic Model specifications define the following features and functionality:

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

564 Therefore, this IPP System Service specification should define:

- 565 1. An IPP binding of the PWG System object;
- 566 2. An IPP binding of the PWG System Control Service to support management and
567 monitoring of Imaging Systems and their configured Imaging Services; and
- 568 3. An IPP binding of the PWG Resource object and the PWG Resource Service.

569 **3.2 Use Cases**

570 **3.2.1 Imaging System Service Enumeration**

571 Jane wants to determine what services are available on an Imaging System and their
572 capabilities. After Jane initiates service enumeration by using the IPP Client on her laptop
573 to send a query to the Imaging System for the list of available services. After receiving the
574 response from the Imaging System, the IPP Client sends further queries to each Imaging
575 Service for its capabilities and configuration. Finally, the IPP Client displays the list of
576 available Imaging Services and their capabilities.

577 **3.2.2 Imaging System Monitoring**

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

582 **3.2.3 Imaging System Management**

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

586 **3.2.4 Resource Management**

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

590 **3.2.5 Bootstrap Client Access to Default Print Service**

591 Jane sees that there's a new network printer installed in the hall near her office that has an
592 IPv4 address written on the top (e.g., "10.1.2.3"). She wants to use that network printer, but
593 doesn't know how to find the specific URI of a running print service on that machine. She
594 uses the IPP Client on her laptop to query the IPP System Service that listens on the
595 standard IPP port (e.g., "ipp://10.1.2.3:631") on that machine to find the default print service
596 URI on that machine (e.g., "ipp://printer12.example.com/ipp/print").

3.3 Exceptions

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

3.4 Out of Scope

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

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

3.5 Design Requirements

The design requirements for this IPP System Service specification are:

1. Follow the naming conventions defined in IPP/1.1: Model and Semantics [RFC8011], including keyword value case (lower) and hyphenation requirements;
2. Define objects, attribute groups, attributes, and values to support the System object, Resource object, and System Service;
3. Define operations to support the System Service and the use cases defined in section 3.2; and
4. Register all new IPP attributes, attribute groups, objects, operations, status codes, and values with IANA.

4. IPP Object Model

This specification extends the original IPP Model defined in section 2 of IETF IPP/1.1 Model and Semantics [RFC8011] from the original print service scope to include all Imaging Services on a managed Imaging System.

4.1 System Object

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

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

Note: Since Systems are typically long-lived objects, System Owners are mutable (i.e., System Description attributes).

4.2 Subunit Object

This specification identifies a component object called a “Subunit” that is an IPP binding of the Subunit object defined in PWG MFD Model and Common Semantics [PWG5801.01] and is based on the Subunit (hardware or software component) defined in IETF Printer MIB v2 [RFC3805]. This specification does not define any explicit System object attributes to refer to Subunit objects. Instead, existing IPP Printer object attributes (e.g., “printer-input-tray” defined in [PWG5100.13]) can be used to convey information about Subunit objects.

4.3 Printer Object

This specification extends the original IPP Printer object defined in IETF IPP/1.1 Model and Semantics [RFC8011] to represent any Imaging Service (print, scan, etc.), in order to reuse existing IPP Printer operations and attributes in the individual Imaging Services, but NOT directly in this specification.

Note: Since Printers are typically long-lived objects, Printer Owners are mutable (i.e., Printer Description attributes).

4.4 Job Object

This specification extends the original IPP Job object defined in IETF IPP/1.1 Model and Semantics [RFC8011] to represent a Job on any Imaging Service (Print, Scan, etc.), in order to reuse existing IPP Job operations and attributes in the individual Imaging Services, but NOT directly in this specification.

651 Note: Since Jobs are typically short-lived objects, Job Owners are immutable (i.e., Job
652 Status attributes).

653 **4.5 Document Object**

654 This specification extends the original IPP Document object defined in IETF IPP/1.1 Model
655 and Semantics [RFC8011] to represent a Document contained in a Job on any Imaging
656 Service (Print, Scan, etc.), in order to reuse existing IPP Document operations and attributes
657 in the individual Imaging Services, but NOT directly in this specification.

658 **4.6 Resource Object**

659 This specification extends the original Resource object defined in PWG Network Resource
660 Service [PWG5108.03], in order to incorporate Resource operations directly into the IPP
661 System Service. Resources are managed by the System and each Resource has a system-
662 wide unique status attribute “resource-id”. Resources are persistent until they are explicitly
663 canceled by an Administrator or aborted by the System.

664 Resources have an allocation scope of System, Printer, or Job. Throughout this
665 specification, the phrases “[System|Printer|Job]-scope Resource” and “per-
666 [System|Printer|Job] Resource” are used to specify the usage of Resources.

667 Creation of a new Resource is supported via the Create-Resource operation and “resource-
668 use-count” will be set to zero. Upload of Resource data is supported via the Send-Resource-
669 Data operation. Installation of a Resource (for subsequent use) is supported via the Install-
670 Resource operation. For a System-scope Resource, “resource-use-count” will be set to one
671 after the Resource is successfully installed. For a Printer-scope or Job-scope Resource,
672 “resource-use-count” will be incremented by one each time that the Resource is allocated to
673 a Printer or a Job, e.g., via Allocate-Printer-Resource or a Job Creation operation that
674 includes a “resource-ids” operation attribute. When an allocated Resource is busy at the
675 time of a Cancel-Resource request, ‘cancel-requested’ will be added to the “resource-state-
676 reasons” and the Resource will not transition to a “resource-state” of ‘canceled’ until the
677 allocated Resource is no longer busy, as indicated by a “resource-use-count” value of zero.

678 See Figure 2 in section 7.8.8 for a diagram of normal Resource state transitions. Resources
679 in this specification do not have leases and expiration times, as they formerly did in the
680 original Resource object defined in [PWG5108.03].

681 IPP System Service implementations SHOULD support System-scope executable
682 resources (e.g., for firmware update). System Service implementations MAY support Printer-
683 scope and/or Job-scope executable resources in an implementation-defined manner.

684 Note: Since Resources are typically long-lived objects, Resource Owners are mutable (i.e.,
685 Resource Description attributes).

4.6.1 Resource History

The System MUST support an implementation-defined Resource History phase of at least 300 seconds, to preserve the integrity of system log files. The System SHOULD “age” out (i.e., delete) Resource objects with “resource-state” of ‘canceled’ or ‘aborted’ from the Resource History when they have exceeded the implementation-defined Resource History period. This is analogous to the handling of Job objects in a terminal state as discussed in the section “Partitioning of Job States” in [RFC8011]. However, unlike Job objects, the Resource object associated data referenced by “resource-data-uri” SHOULD be discarded as soon as the Resource transitions to the ‘canceled’ or ‘aborted’ terminal state (instead of at the end of the Resource History phase).

4.7 Subscription Object

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

Note: Since Subscriptions are typically short-lived objects, Subscription Owners are immutable (i.e., Subscription Status attributes).

5. IPP Objects and Operations Summary

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

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

This specification defines additional attributes for the Printer and Job objects [RFC8011].

Note: All tables in this section list only top-level attributes. Collection member attributes are not listed here and are described in detail in section 7 IPP Attributes below their enclosing collection attributes.

5.1 System Attribute Group

This document defines the system-attributes-tag (0x0A) for a System attribute group.

5.2 System Description Attributes

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

Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined equivalent attribute and the attribute is defined for the first time in this specification.

Table 1 – IPP System Description Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	charset-configured	CharsetConfigured[1]	[PWG5108.06]
REQUIRED	charset-supported	CharsetSupported[1]	[PWG5108.06]
REQUIRED	document-format-supported	document-format-supported	[RFC8011]
REQUIRED	generated-natural-language-supported	NaturalLanguageSupported[1]	[PWG5108.06]
REQUIRED	ipp-features-supported	ipp-features-supported	[PWG5100.13]
REQUIRED	ipp-versions-supported	VersionsSupported[1]	[PWG5108.06]
REQUIRED	multiple-document-printers-supported	multiple-document-jobs-supported	[RFC8011]
REQUIRED	natural-language-configured	NaturalLanguageConfigured[1]	[PWG5108.06]
REQUIRED	operations-supported	OperationsSupported[1]	[PWG5108.06]
OPTIONAL	power-calendar-policy-col	PowerCalendar	[PWG5108.06]
OPTIONAL	power-event-policy-col	PowerEvent	[PWG5108.06]
RECOMMENDED	power-timeout-policy-col	PowerTimeout[3]	[PWG5108.06]
REQUIRED	printer-creation-attributes-supported	job-creation-attributes-supported [8]	[PWG5100.11]
REQUIRED	printer-service-type-supported	ServiceType	[PWG5108.06]
REQUIRED	resource-format-supported	document-format-supported [10]	[RFC8011]
REQUIRED	resource-type-supported	document-format-supported [11]	[RFC8011]
REQUIRED	resource-settable-attributes-supported	job-settable-attributes-supported [7]	[RFC3380]
REQUIRED	system-current-time	CurrentTime[2]	[PWG5108.06]
REQUIRED	system-default-printer-id	<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]
REQUIRED	system-mandatory-printer-attributes	printer-mandatory-job-attributes [9]	[PWG5100.13]
OPTIONAL	system-message-from-operator	MessageFromOperator	[PWG5108.06]
REQUIRED	system-name	SystemName[2]	[PWG5108.06]
REQUIRED	system-owner-col	OwnerUri, OwnerVCard[4]	[PWG5108.06]
REQUIRED	system-settable-attributes-supported	printer-settable-attributes-supported [6]	[RFC3380]
REQUIRED	system-xri-supported	XriSupported	[PWG5108.06]

722

723 Notes:

- 724 1. REQUIRED for a Printer per IETF IPP/1.1 Model and Semantics [RFC8011].
725 2. REQUIRED for a Printer per PWG IPP Everywhere [PWG5100.14].
726 3. REQUIRED or RECOMMENDED for a System per PWG Power Management
727 Model [PWG5106.4].
728 4. REQUIRED for all Systems since they MUST support the Set-System-Attributes
729 operation – also “owner-uri” and “owner-vcard” MUST be updated
730 simultaneously if specified in a Set-System-Attributes operation (to preserve
731 consistency).
732 5. REQUIRED for a System to support the Get-Printer-Attributes operation which
733 can use the implementation-defined or administratively-configured “default”
734 Printer object as a target.
735 6. REQUIRED for System support of the REQUIRED Set-System-Attributes
736 operation and semantically analogous to the “printer-settable-attributes-
737 supported” Printer Description attribute defined in Internet Printing Protocol
738 (IPP): Job and Printer Set Operations [RFC3380].
739 7. REQUIRED for System support of the REQUIRED Set-Resource-Attributes
740 operation and semantically analogous to the “job-settable-attributes-supported”
741 Job Description attribute defined in Internet Printing Protocol (IPP): Job and
742 Printer Set Operations [RFC3380].
743 8. REQUIRED for System support of the REQUIRED Create-Printer operation and
744 semantically analogous to the “job-creation-attributes-supported” Printer
745 Description attribute defined in Internet Printing Protocol (IPP): Job and Printer
746 Extensions – Set 2 [PWG5100.11].
747 9. REQUIRED for System support of the REQUIRED Create-Printer operation and
748 semantically analogous to the “printer-mandatory-job-attributes” Printer
749 Description attribute defined in IPP: Job and Printer Extensions – Set
750 3[PWG5100.13].
751 10. REQUIRED for System support of the REQUIRED Send-Resource-Data
752 operation and semantically analogous to the “document-format-supported”
753 Printer Description attribute defined in [RFC8011].
754 11. REQUIRED for System support of the REQUIRED Create-Resource operation
755 and semantically analogous to the “document-format-supported” Printer
756 Description attribute defined in [RFC8011].

757 5.3 System Status Attributes

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

761 Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined
762 equivalent attribute and the attribute is defined for the first time in this specification.

Table 2 – IPP System Status Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
RECOMMENDED	power-log-col	PowerLog[3]	[PWG5108.06]
OPTIONAL	power-state-capabilities-col	PowerSupport	[PWG5108.06]
OPTIONAL	power-state-counters-col	PowerCounters	[PWG5108.06]
RECOMMENDED	power-state-monitor-col	PowerMonitor[3]	[PWG5108.06]
OPTIONAL	power-state-transitions-col	PowerTransition	[PWG5108.06]
REQUIRED	system-config-change-date-time	printer-config-change-date-time [8]	[PWG5100.13]
REQUIRED	system-config-change-time	printer-config-change-time [8]	[PWG5100.13]
REQUIRED	system-config-changes	SystemConfigChangeNumber[5]	[PWG5108.06]
REQUIRED	system-configured-printers	ConfiguredServices	[PWG5108.06]
REQUIRED	system-configured-resources	ConfiguredResources	[PWG5108.06]
RECOMMENDED	system-impressions-completed	SystemTotals	[PWG5108.06]
RECOMMENDED	system-impressions-completed-col	SystemTotals	[PWG5108.06]
RECOMMENDED	system-media-sheets-completed	SystemTotals	[PWG5108.06]
RECOMMENDED	system-media-sheets-completed-col	SystemTotals	[PWG5108.06]
RECOMMENDED	system-pages-completed	SystemTotals	[PWG5108.06]
RECOMMENDED	system-pages-completed-col	SystemTotals	[PWG5108.06]
OPTIONAL	system-serial-number	SerialNumber[5]	[PWG5108.06]
REQUIRED	system-state	State[1]	[PWG5108.06]
REQUIRED	system-state-change-date-time	printer-state-change-date-time [8]	[RFC3995]
REQUIRED	system-state-change-time	printer-state-change-time [8]	[RFC3995]
REQUIRED	system-state-message	StateMessages[2]	[PWG5108.06]
REQUIRED	system-state-reasons	StateReasons[2]	[PWG5108.06]
RECOMMENDED	system-strings-languages-supported	printer-strings-languages-supported[9]	[PWG5100.13]
RECOMMENDED	system-strings-uri	printer-strings-uri[9]	[PWG5100.13]
REQUIRED	system-up-time	UpTime[2]	[PWG5108.06]
REQUIRED	system-uuid	ServiceUuid[2] [7]	[PWG5108.01]

Notes:

1. REQUIRED for a Printer per IETF IPP/1.1 Model and Semantics [RFC8011].
2. REQUIRED for a Printer per PWG IPP Everywhere [PWG5100.14].
3. REQUIRED or RECOMMENDED for a System per PWG Power Management Model [PWG5106.4] – Power General, Meters, and Monitor groups have been combined into the “power-state-monitor-col” System attribute.
4. Summary of SystemConfiguration group (subunits) – similar to ConfiguredServices in [PWG5108.06].
5. REQUIRED for a Printer per IETF Printer MIB v2 [RFC3805].
6. REQUIRED for a System per PWG Imaging System Counters [PWG5106.1].
7. The System object “system-uuid” attribute identifies the System Service and is semantically analogous to the Printer object “printer-uuid” defined in IPP Job and

- Printer Extensions – Set 3 (JPS3) [PWG5100.13] that identifies a specific Imaging Service (e.g., Print, Scan, FaxOut, etc.).
8. The System object “system-config-change-[date-time|time]” and “system-state-change-[date-time|time]” attributes are necessary to support System event notifications per IPP: Events Notifications and Subscriptions [RFC3995] and are semantically analogous to the Printer object “printer-config-change-[date-time|time]” attributes defined in [PWG5100.13] and “printer-state-change-[date-time|time]” attributes defined in [RFC3995].
 9. The System object “system-strings-languages-supported” and “system-strings-uri” attributes are necessary to support Client-side localizations and are semantically analogous to the Printer object “printer-strings-languages-supported” and “printer-strings-uri” attributes defined in IPP Job and Printer Extensions – Set 3 (JPS3) [PWG5100.13].

5.4 System Operations

The operations for an IPP System Service conforming to this specification are listed in Table 3. All of these operations are REQUIRED except for Register-Output-Device which is CONDITIONALLY REQUIRED for Systems that implement IPP Shared Infrastructure Extensions [PWG5100.18]

Note: An SM/IPP/DPA[ISO10175-3] Equivalent entry of “<none>” indicates that there is no previously defined equivalent operation and the operation is defined for the first time in this specification.

Table 3 – IPP System Service Operations

Code	IPP Operation Name	SM/IPP/DPA Equivalent	Reference
0x004B	Allocate-Printer-Resources	<none>	<none>
0x0052	Cancel-Resource	DeleteResource	[PWG5108.03]
0x001B	Cancel-Subscription	Cancel-Subscription[8]	[RFC3995]
0x004C	Create-Printer	Create[5]	[ISO10175-3]
0x0053	Create-Resource	StoreResource[3]	[PWG5108.03]
0x0057	Create-Resource-Subscriptions	Create-Printer-Subscriptions[8]	[RFC3995]
0x0058	Create-System-Subscriptions	Create-Printer-Subscriptions [8]	[RFC3995]
0x004D	Deallocate-Printer-Resources	<none>	<none>
0x004E	Delete-Printer	DeleteService	[PWG5108.06]
0x0059	Disable-All-Printers	DisableAllServices[2]	[PWG5108.06]
0x005A	Enable-All-Printers	EnableAllServices[2]	[PWG5108.06]
0x001C	Get-Notifications	Get-Notifications[8]	[RFC3996]
0x004F	Get-Printers	ListAllServices	[PWG5108.06]
0x000B	Get-Printer-Attributes	Get-Printer-Attributes	[RFC8011]
0x0065	Get-Printer-Resources	<none>[10]	<none>
0x0020	Get-Resources	ListResources	[PWG5108.03]
0x001E	Get-Resource-Attributes	GetResourceElements	[PWG5108.03]
0x0019	Get-Subscriptions	Get-Subscriptions [8]	[RFC3995]

0x0018	Get-Subscription-Attributes	Get-Subscription-Attributes [8]	[RFC3995]
0x005B	Get-System-Attributes	GetSystemElements	[PWG5108.06]
0x005C	Get-System-Supported-Values	Get-Printer-Supported-Values [7]	[RFC3380]
0x0054	Install-Resource	StoreResource [3][4]	[PWG5108.03]
0x005D	Pause-All-Printers	PauseAllServices	[PWG5108.06]
0x005E	Pause-All-Printers-After-Current-Job	PauseAllServicesAfterCurrent Job[1]	[PWG5108.06]
0x005F	Register-Output-Device	RegisterSystem[6]	[PWG5109.1]
0x001A	Renew-Subscription	Renew-Subscription[8]	[RFC3995]
0x0060	Restart-System	Restart-Printer[9]	[RFC3998]
0x0061	Resume-All-Printers	ResumeAllServices	[PWG5108.06]
0x0055	Send-Resource-Data	StoreResource[3]	[PWG5108.03]
0x0056	Set-Resource-Attributes	SetResourceElements	[PWG5108.03]
0x0062	Set-System-Attributes	SetSystemElements	[PWG5108.06]
0x0063	Shutdown-All-Printers	ShutdownAllServices	[PWG5108.06]
0x0050	Shutdown-One-Printer	ShutdownService	[PWG5108.06]
0x0064	Startup-All-Printers	StartupAllServices	[PWG5108.06]
0x0051	Startup-One-Printer	StartupService	[PWG5108.06]

799 Notes:

- 800 1. Pause-All-Printers-After-Current-Job is a useful operation for graceful stopping
801 of all Printers (Imaging Services) on an Imaging System, but it can be an
802 arbitrarily long duration operation.
- 803 2. [Enable/Disable]-Printer and [Pause/Resume]-Printer are intentionally left out of
804 this specification – they should be directed to the specific Imaging Service that is
805 enumerated in the “system-configured-printers” attribute defined in section 5.x
806 above.
- 807 3. Create-Resource, Send-Resource-Data, and Install-Resource are intentionally
808 decomposed from the original ambiguously scoped StoreResource operation
809 specified in PWG Resource Service [PWG5108.03]. Create-Resource is
810 semantically equivalent to Create (for a Resource object) defined in ISO
811 Document Printing Application (DPA) Part 3: Management Abstract Service
812 Definition and Procedures [ISO10175-3] where a newly created Resource object
813 has the special initial state of ‘unknown’ (which is NOT defined or used in this
814 specification).
- 815 4. Install-Resource is used to install (for subsequent use) a Resource for use after
816 Create-Resource (metadata) and Send-Resource-Data (upload data) have
817 completed.
- 818 5. Create-Printer is semantically equivalent to Create (for a Printer object) defined
819 in ISO Document Printing Application (DPA) Part 3: Management Abstract
820 Service Definition and Procedures [ISO10175-3] (where a newly created Printer
821 object had the special initial state of ‘unknown’, which is NOT defined or used in
822 this specification).
- 823 6. Register-Output-Device is semantically equivalent to RegisterSystem defined in
824 PWG Cloud Imaging Model [PWG5109.1] with the difference that the System
825 itself is not registered, but rather the associated Output Devices are registered.

- Register-Output-Device is CONDITIONALLY REQUIRED for Systems that implement IPP Shared Infrastructure Extensions [PWG5100.18].
7. Get-System-Supported-Values is semantically equivalent to Get-Printer-Supported-Values in IPP: Job and Printer Set Operations [RFC3380] and is necessary for support of the REQUIRED Set-System-Attributes operation.
 8. REQUIRED for a System and/or Resource and analogous to the operations defined in IPP: Event Notifications and Subscriptions [RFC3995] and IPP: The 'ippget' Delivery Method for Event Notifications [RFC3996]. Cancel-Subscription, Get-Notifications, Get-Subscription-Attributes, Get-Subscriptions, and Renew-Subscription (all defined in [RFC3995]) are extended by this specification for use with the IPP System Service.
 9. REQUIRED for a System and analogous to the Restart-Printer operation defined in IPP: Job and Printer Administrative Operations [RFC3998].
 10. REQUIRED for a Printer and analogous to Get-Resources operation defined in this specification.

5.5 Resource Attribute Group

This document defines the resource-attributes-tag (0x08) for a Resource attribute group.

5.6 Resource Description Attributes

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

Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined equivalent attribute and the attribute is defined for the first time in this specification.

Note: Printer-scope Resource objects MAY be:

1. Created **before** the related Create-Printer operation and then associated with a given Printer using a Create-Printer operation via the “resource-ids” operation attribute to update the “printer-resource-ids” Printer Status attribute;
2. Created **after** the related Create-Printer operation and then associated with a given Printer using an Allocate-Printer-Resources operation via the “resource-ids” operation attribute to update the “printer-resource-ids” Printer Status attribute; or
3. Created **after** the related Create-Printer operation and then associated with a given Printer using an HTTP PUT request [RFC7230] as defined in section 4.1.9 Resources of IPP Shared Infrastructure Extensions [PWG5100.18] to update the “printer-resource-ids” Printer Status attribute.

Note: Job-scope Resource objects MUST be created **before** the Job creation operation and then associated with a given Job via the “resource-ids” Job creation operation attribute to update the “job-resource-ids” Job Status attribute.

Table 4 – IPP Resource Description Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	resource-info	ResourceInfo	[PWG5108.03]
REQUIRED	resource-name	ResourceName	[PWG5108.03]
REQUIRED	resource-owner-col	OwnerUri, OwnerVCard[1]	[PWG5108.06]

Notes:

1. REQUIRED for a Resource by analogy to “system-owner-col” in System since all Systems MUST support the Set-Resource-Attributes operation to conform to this IPP System Service specification – also “owner-uri” and “owner-vcard” MUST be updated simultaneously if specified in a Set-Resource-Attributes operation (to preserve consistency).

5.7 Resource Status Attributes

The READ-ONLY attributes in the IPP Resource Status group are listed in Table 5. These attributes are inherently READ-ONLY and can only be modified indirectly as a side effect of one or more IPP System Service operations, but NOT by a Set-Resource-Attributes operation. See Figure 2 in section 7.8.8 resource-state for a diagram of normal Resource state transitions.

Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined equivalent attribute and the attribute is defined for the first time in this specification.

Table 5 – IPP Resource Status Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	date-time-at-canceled	date-time-at-completed [1]	[RFC8011]
REQUIRED	date-time-at-creation	date-time-at-creation [1]	[RFC8011]
REQUIRED	date-time-at-installed	date-time-at-processing [1][6]	[RFC8011]
REQUIRED	resource-data-uri	<none>	<none>
REQUIRED	resource-format	ResourceFormat	[PWG5108.03]
REQUIRED	resource-id	ResourceId[4]	[PWG5108.03]
REQUIRED	resource-k-octets	job-k-octets[2][5]	[RFC8011]
REQUIRED	resource-state	job-state[2]	[RFC8011]
REQUIRED	resource-state-reasons	job-state-reasons[2]	[RFC8011]
REQUIRED	resource-string-version	XxxStringVersion[7]	[PWG5110.1]
REQUIRED	resource-type	ResourceType	[PWG5108.03]
REQUIRED	resource-use-count	<none>	<none>
REQUIRED	resource-uuid	job-uuid[3]	[PWG5100.13]
REQUIRED	resource-version	XxxVersion[7]	[PWG5110.1]
REQUIRED	time-at-canceled	time-at-completed[2]	[RFC8011]
REQUIRED	time-at-creation	time-at-creation[2]	[RFC8011]
REQUIRED	time-at-installed	time-at-processing [2][6]	[RFC8011]

Notes:

1. REQUIRED for a Resource by analogy to PWG Network Resource Service Semantic Model and Service Interface [PWG5108.03] and “date-time-at-completed” “date-time-at-creation”, and “date-time-at-processing” Job attributes defined in IETF IPP/1.1 Model and Semantics [RFC8011].
2. REQUIRED for a Resource by analogy to “job-state”, “job-state-reasons”, “time-at-completed” “time-at-creation”, and “time-at-processing” Job attributes defined in IETF IPP/1.1 Model and Semantics [RFC8011].
3. REQUIRED for a Resource by analogy to “job-uuid” Job attribute defined in PWG IPP: Job and Printer Extensions – Set 3 (JPS3) [PWG5100.13].
4. REQUIRED for a Resource by analogy to PWG Network Resource Service Semantic Model and Service Interface [PWG5108.03] and Job in IETF IPP/1.1 Model and Semantics [RFC8011]. See section 7.6 of this specification for details of the “resource-id” attribute which MUST be monotonically increasing (as is “job-id”) to avoid re-use of “resource-id” values and resulting ambiguity in log files.
5. REQUIRED for a Resource by analogy to a “job-k-octets” Job attribute defined in IETF IPP/1.1 Model and Semantics [RFC8011].
6. REQUIRED for a Resource by analogy to “date-time-at-processing” and “time-at-processing” Job attributes defined in [RFC8011] and set by System during an Install-Resource operation.
7. REQUIRED for a Resource by analogy to the functionally equivalent [Firmware|ResidentApplication|UserApplication]StringVersion and [Firmware|ResidentApplication|UserApplication]Version elements defined in PWG Hardcopy Device Health Assessment Attributes [PWG5110.1] and PWG Hardcopy Device Health Assessment Trusted Network Connect Binding [PWG5110.4].

5.8 Printer Description Attributes

Additional potentially READ-WRITE attributes in the IPP Printer Description group are listed in Table 6.

Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined equivalent attribute and the attribute is defined for the first time in this specification.

Table 6 – IPP Printer Description Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	printer-owner-col	OwnerUri, OwnerVCard[1]	[PWG5108.06]

Notes:

1. REQUIRED for a Printer by analogy to “system-owner-col” in System since all Systems MUST support the Set-Printer-Attributes operation to conform to this IPP System Service specification – also “owner-uri” and “owner-vcard” MUST be

918 updated simultaneously if specified in a Set-Printer-Attributes operation (to
919 preserve consistency).

920 5.9 Printer Status Attributes

921 Additional READ-ONLY attributes in the IPP Printer Status group are listed in Table 7.

922 Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined
923 equivalent attribute and the attribute is defined for the first time in this specification.

924 **Table 7 – IPP Printer Status Attributes**

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	printer-config-changes	ConfigChanges[1]	[PWG5106.1]
REQUIRED	printer-id	ID[2]	[PWG5108.06]
RECOMMENDED	printer-impressions-completed	PrintServiceCounters	[PWG5108.01]
RECOMMENDED	printer-impressions-completed-col	PrintServiceCounters	[PWG5108.01]
RECOMMENDED	printer-media-sheets-completed	PrintServiceCounters	[PWG5108.01]
RECOMMENDED	printer-media-sheets-completed-col	PrintServiceCounters	[PWG5108.01]
RECOMMENDED	printer-pages-completed	PrintServiceCounters	[PWG5108.01]
RECOMMENDED	printer-pages-completed-col	PrintServiceCounters	[PWG5108.01]
REQUIRED	printer-resource-ids	<none>[4]	<none>
REQUIRED	printer-service-type	ServiceType[3]	[PWG5108.06]

925 Notes:

- 926 1. REQUIRED for all Printers and semantically equivalent to the Monitoring
927 element ConfigChanges defined in [PWG5106.1] and semantically equivalent to
928 “prtGeneralConfigChanges” in IETF Printer MIB v2 [RFC3805].
- 929 2. REQUIRED for all Printers and semantically equivalent to the ServiceSummary
930 element ID defined in [PWG5108.06] and semantically analogous to the “job-id”
931 attribute defined in [RFC2911].
- 932 3. REQUIRED for all Printers and semantically equivalent to the ServiceSummary
933 element ServiceType defined in [PWG5108.06].
- 934 4. REQUIRED for all Printers since all Systems MUST support the assignment of
935 requested Printer-scope Resources via the “resource-ids” Create-Printer
936 operation attribute to conform to this IPP System Service specification.
937

5.10 Job Status Attributes

Additional READ--ONLY attributes in the IPP Job Status group are listed in Table 8.

Note: An SM/IPP Equivalent entry of “<none>” indicates that there is no previously defined equivalent attribute and the attribute is defined for the first time in this specification.

Table 8 – IPP Job Status Attributes

Conformance	IPP Attribute Name	SM/IPP Equivalent	Reference
REQUIRED	job-owner-col	OwnerUri, OwnerVCard[1]	[PWG5108.06]
REQUIRED	job-resource-ids	<none>[2]	<none>

Notes:

1. REQUIRED for a Job by analogy to “system-owner-col” in System since all Systems MUST support the Set-Job-Attributes operation to conform to this IPP System Service specification – also “owner-uri” and “owner-vcard” MUST be updated simultaneously if specified in a Set-Job-Attributes operation (to preserve consistency all Systems since they MUST support the “requesting-user-vcard” Job Creation operation attribute to conform to this IPP System Service specification.
2. REQUIRED for all Jobs since all Systems MUST support the assignment of requested Job-scope Resources via the “resource-ids” Job Creation operation attribute to conform to this IPP System Service specification.

6. IPP Operations

IPP System Service implementations MUST support Client authentication and Client authorization based on System policy. Except for Get-Printer-Attributes, all System Service operations MAY require Client authentication based on System policy. All IPP Clients MUST support HTTP Basic authentication and SHOULD support HTTP Digest authentication per [RFC8011].

Note: Get-Printer-Attributes does not require Client authentication for backwards compatibility with existing Clients.

Note: All IPP System Service operation requests and responses use standard operation parameters as defined in [RFC8011] and encoded in [RFC8010].

6.1 Printer Operations

IPP System Service operations on single Printer objects (except for Get-Printers) are defined in this section.

968 Note: The System MUST copy the value of any supplied “printer-message-from-operator”
969 operation attribute to any affected Printer objects (for Create-Printer, Shutdown-One-Printer,
970 and Startup-One-Printer).

971 **6.1.1 Allocate-Printer-Resources**

972 This REQUIRED operation allows an authorized Operator or Administrator to allocate
973 Resources to an existing Printer object on the target System object and update “resource-
974 use-count” in each Resource. If the Printer object is already shutdown, with ‘shutdown’ in
975 the “printer-state-reasons”, then the System MUST return a “status-code” of ‘client-error-
976 forbidden’.

977 **6.1.1.1 Allocate-Printer-Resources Request**

978 The following groups of attributes are part of an Allocate-Printer-Resources request.

979 Group 1: Operation Attributes

980 "attributes-charset" (charset) and
981 "attributes-natural-language" (naturalLanguage):

982 The Client MUST supply and the System MUST support both of these
983 attributes.

984 “system-uri” (uri):

985 The Client MUST supply and the System MUST support the “system-uri”
986 operation attribute which is the target System for the operation.

987 “printer-id” (integer(1:65535)):

988 The Client MUST supply and the System MUST support this operation
989 attribute which is the target Printer for the operation.

990 "requesting-user-name" (name(MAX)) and
991 "requesting-user-uri" (uri) and
992 “requesting-user-vcard” (1setOf text(MAX)):

993 The Client SHOULD supply and the System MUST support all three of these
994 attributes.

995 “resource-ids” (1setOf integer(1:MAX)):

996 The Client MUST supply and the System MUST support this attribute.

997 **6.1.1.2 Allocate-Printer-Resources Response**

998 The following groups of attributes are part of an Allocate-Printer-Resources response.

999 Group 1: Operation Attributes

1000 "attributes-charset" (charset) and
1001 "attributes-natural-language" (naturalLanguage):

1002 The System MUST return both of these attributes.

1003 "status-message" (text(255)) and/or
1004 "detailed-status-message" (text(MAX)):

1005 The System MAY return one or both of these attributes.

1006 Group 2: Unsupported Attributes

1007 See [RFC8011] for details on returning Unsupported Attributes.

1008 Group 3: Printer Attributes

1009 See [RFC8011] for details on returning Printer Attributes.

1010 "printer-id" (integer(1:65535)):

1011 The System MUST return this attribute.

1012 "printer-resource-ids" (1setOf integer(1:MAX)):

1013 The System MUST return this attribute, which contains the complete list of
1014 Resources currently allocated to this Printer (including all of the valid ones
1015 listed in the request attribute "resource-ids").

1016 **6.1.2 Deallocate-Printer-Resources**

1017 This REQUIRED operation allows an authorized Operator or Administrator to deallocate
1018 Resources from an existing Printer object on the target System object and update "resource-
1019 use-count" in each Resource. If the Printer object is already shutdown, with 'shutdown' in
1020 the "printer-state-reasons", then the System MUST return a "status-code" of 'client-error-
1021 forbidden'.

1022 **6.1.2.1 Deallocate-Printer-Resources Request**

1023 The following groups of attributes are part of a Deallocate-Printer-Resources request.

1024 Group 1: Operation Attributes

1025 "attributes-charset" (charset) and
1026 "attributes-natural-language" (naturalLanguage):

1027 The Client MUST supply and the System MUST support both of these
1028 attributes.

1029 “system-uri” (uri):

1030 The Client MUST supply and the System MUST support the “system-uri”
1031 operation attribute which is the target System for the operation.

1032 “printer-id” (integer(1:65535)):

1033 The Client MUST supply and the System MUST support this operation
1034 attribute which is the target Printer for the operation.

1035 "requesting-user-name" (name(MAX)) and
1036 "requesting-user-uri" (uri) and
1037 "requesting-user-vcard" (1setOf text(MAX)):

1038 The Client SHOULD supply and the System MUST support all three of these
1039 attributes.

1040 “resource-ids” (1setOf integer(1:MAX)):

1041 The Client MUST supply and the System MUST support this attribute.

1042 **6.1.2.2 Deallocate-Printer-Resources Response**

1043 The following groups of attributes are part of a Deallocate-Printer-Resources response.

1044 Group 1: Operation Attributes

1045 "attributes-charset" (charset) and
1046 "attributes-natural-language" (naturalLanguage):

1047 The System MUST return both of these attributes.

1048 "status-message" (text(255)) and/or
1049 "detailed-status-message" (text(MAX)):

1050 The System MAY return one or both of these attributes.

1051 Group 2: Unsupported Attributes

1052 See [RFC8011] for details on returning Unsupported Attributes.

1053 Groups 3: Printer Attributes

1054 See [RFC8011] for details on returning Printer Attributes.

1055 “printer-id” (integer(1:65535)):

1056 The System MUST return this attribute.

1057 “printer-resource-ids” (1setOf integer(1:MAX)):

1058 The System MUST return this attribute, which contains the complete list of
1059 remaining Resources currently allocated to this Printer (after removing all of
1060 the valid ones listed in the request attribute “resource-ids”).

1061 **6.1.3 Delete-Printer**

1062 This REQUIRED operation allows an authorized Operator or Administrator to delete entirely
1063 one configured Printer object (i.e., Job processing service) on the target System object. If
1064 the Printer object is not already shutdown, with ‘shutdown’ in the “printer-state-reasons”,
1065 then the System MUST return a “status-code” of ‘client-error-forbidden’.

1066 This operation is semantically equivalent to the DeleteService operation defined in
1067 [PWG5108.06]. The Printer object and all associated Jobs will be removed entirely. The
1068 Printer object cannot be subsequently started up with a Startup-One-Printer operation.

1069 If accepted, the System MUST shutdown the specified Printer with the “printer-state” set to
1070 ‘stopped’ (i.e., no Jobs can be processed and intervention is required) and the ‘shutdown’
1071 value added to “printer-state-reasons”. This operation MAY change the state of the System
1072 itself to ‘stopped’ (if there are no other configured Printers or all other Printers already had
1073 a “printer-state” of ‘stopped’).

1074 **6.1.3.1 Delete-Printer Request**

1075 The following groups of attributes are part of a Delete-Printer request.

1076 Group 1: Operation Attributes

1077 “attributes-charset” (charset) and
1078 “attributes-natural-language” (naturalLanguage):

1079 The Client MUST supply and the System MUST support both of these
1080 attributes.

1081 “system-uri” (uri):

1082 The Client MUST supply and the System MUST support the “system-uri”
1083 operation attribute which is the target System for the operation.

1084 “printer-id” (integer(1:65535)):

1085 The Client MUST supply and the System MUST support this operation
1086 attribute which is the target Printer for the operation.

1087 "requesting-user-name" (name(MAX)) and
1088 "requesting-user-uri" (uri) and
1089 "requesting-user-vcard" (1setOf text(MAX)):

1090 The Client SHOULD supply and the System MUST support all three of these
1091 attributes.

1092 **6.1.3.2 Delete-Printer Response**

1093 The following groups of attributes are part of a Delete-Printer response.

1094 Group 1: Operation Attributes

1095 "attributes-charset" (charset) and
1096 "attributes-natural-language" (naturalLanguage):

1097 The System MUST return both of these attributes.

1098 "status-message" (text(255)) and/or
1099 "detailed-status-message" (text(MAX)):

1100 The System MAY return one or both of these attributes.

1101 Group 2: Unsupported Attributes

1102 See [RFC8011] for details on returning Unsupported Attributes.

1103 Groups 3: Printer Attributes

1104 See [RFC8011] for details on returning Printer Attributes.

1105 "printer-id" (integer(1:65535)):

1106 The System MUST return this attribute.

1107 "printer-uuid" (uri(45)):

1108 The System MUST return this attribute.

1109 "printer-xri-supported" (1setOf collection)

1110 The System MUST return this attribute.

1111 "printer-state" (type1 enum) and
1112 "printer-state-reasons" (1setOf type2 keyword) and
1113 "printer-is-accepting-jobs" (boolean):

1114 The System MUST return all three of these attributes.

1115 Group 4: System Attributes

1116 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

1117 “system-uuid” (uri(45)):

1118 The System MUST return this attribute.

1119 “system-xri-supported” (1setOf collection)

1120 The System MUST return this attribute.

1121 “system-state” (type1 enum) and

1122 “system-state-reasons” (1setOf type2 keyword):

1123 The System MUST return both of these attributes.

1124 **6.1.4 Get-Printers**

1125 This REQUIRED operation allows an authorized User to retrieve a filtered list of some or all
1126 of the Printer objects (i.e., Job processing services) on the target System object. If no
1127 Printers match the specified filter criteria, then the System MUST return a “status-code” of
1128 'successful-ok'.

1129 This operation is semantically equivalent to the ListAllServices operation defined in
1130 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Get-Printer-
1131 Attributes [RFC8011] operations to each Printer object.

1132 If accepted, the System MUST return “printer-id” and “printer-xri-supported” for each
1133 matching Printer object. The returned Printers and Printer attributes from the System MAY
1134 also be filtered based on Client access rights (i.e., the value of “requesting-user-name”) or
1135 the specified “document-format”. This operation does not change the state of any Printer or
1136 the System itself.

1137 **6.1.4.1 Get-Printers Request**

1138 The following groups of attributes are part of a Get-Printers request.

1139 Group 1: Operation Attributes

1140 “attributes-charset” (charset) and

1141 “attributes-natural-language” (naturalLanguage):

1142 The Client MUST supply and the System MUST support both of these
1143 attributes.

1144 “system-uri” (uri):

- 1145 The Client MUST supply and the System MUST support the “system-uri”
1146 operation attribute which is the target System for the operation.
- 1147 “printer-ids” (1setOf (integer(1:65535))):
- 1148 The Client MAY supply and the System MUST support the “printer-ids”
1149 operation attribute which is the list of target Printers for the operation.
- 1150 “requesting-user-name” (name(MAX)) and
1151 “requesting-user-uri” (uri) and
1152 “requesting-user-vcard” (1setOf text(MAX)):
- 1153 The Client SHOULD supply and the System MUST support all three of these
1154 attributes.
- 1155 “first-index” (integer(1:MAX)):
- 1156 The Client MAY supply and the System MUST support this attribute.
- 1157 “limit” (integer(1:MAX)):
- 1158 The Client MAY supply and the System MUST support this attribute.
- 1159 “printer-geo-location” (uri):
- 1160 The Client MAY supply and the System MUST support this attribute.
- 1161 “printer-location” (text(127)):
- 1162 The Client MAY supply and the System MUST support this attribute.
- 1163 “printer-service-type” (1setOf (type2 keyword)):
- 1164 The Client MAY supply and the System MUST support this attribute. If this
1165 operation attribute is supplied, then the System MUST return the attributes
1166 and values for the selected Printers (e.g., Printers offering ‘scan’ service).
1167 See “printer-service-type” in section 7.5 Printer Status Attributes.
- 1168 “requested-attributes” (1setOf type2 keyword):
- 1169 The Client MAY supply and the System MUST support this attribute. If this
1170 operation attribute is NOT supplied, then the System MUST only return the
1171 value of the “system-configured-printers” entry for each selected Printer. See
1172 section “system-configured-printers” in section 7.3 System Status Attributes.
- 1173 The Client SHOULD supply only and the System MUST support requests for
1174 Printer attributes that are listed as IPP Printer source attributes in the table in

1175 section 4 Definition of Attribute Types in the IETF LDAP Schema for Printer
1176 Services [RFC7612].

1177 "document-format" (mimeType):

1178 The Client MAY supply and the System MUST support this attribute. If this
1179 operation attribute is supplied, then the System MUST return the attributes
1180 and values that it uses to validate a job on a create or Validate-Job operation
1181 in which this document format is supplied. The System SHOULD return only
1182 (1) those attributes that are supported for the specified format and (2) the
1183 attribute values that are supported for the specified document format.

1184 "which-printers" (type2 keyword):

1185 The Client MAY supply and the System MUST support this attribute. If this
1186 operation attribute is supplied, then the System MUST return the attributes
1187 and values for the selected printers (e.g., Printers in 'idle' state). See "which-
1188 printers" in section 7.1 Operation Attributes.

1189 6.1.4.2 Get-Printers Response

1190 The following groups of attributes are part of a Get-Printers response. The System returns
1191 a Get-Printers operation response to the Client up to the number specified by the "limit"
1192 operation attribute that match the filter criteria as supplied by the Client in the request.

1193 Group 1: Operation Attributes

1194 "attributes-charset" (charset) and
1195 "attributes-natural-language" (naturalLanguage):

1196 The System MUST return both of these attributes, unless no Printers match
1197 the filter criteria specified by the Client.

1198 "status-message" (text(255)) and/or
1199 "detailed-status-message" (text(MAX)):

1200 The System MAY return one or both of these attributes.

1201 Group 2: Unsupported Attributes

1202 See [RFC8011] for details on returning Unsupported Attributes.

1203 Groups 3 to N: Printer Attributes

1204 See [RFC8011] for details on returning Printer Attributes.

1205 "printer-id" (integer(1:65535)):

1206 The System MUST return this attribute for each Printer.

1207 “printer-uuid” (uri(45)):

1208 The System MUST return this attribute for each Printer.

1209 “printer-xri-supported” (1setOf collection):

1210 The System MUST return this attribute for each Printer.

1211 “printer-state” (type1 enum) and

1212 “printer-state-reasons” (1setOf type2 keyword) and

1213 “printer-is-accepting-jobs” (boolean):

1214 The System MUST return all three of these attributes for each Printer.

1215 **6.1.5 Get-Printer-Resources**

1216 This REQUIRED operation allows an authorized End User to retrieve a filtered list of some
1217 or all of the Resource objects allocated on the target Printer object. If no Resources match
1218 the specified filter criteria, then the Printer MUST return a “status-code” of 'successful-ok'.

1219 This operation is semantically analogous to the ListResources operation defined in
1220 [PWG5108.03]. This operation is also semantically analogous the Get-Jobs operation
1221 defined in [RFC8011].

1222 If accepted, the Printer MUST return the “resource-id” for each matching Resource object.
1223 This operation does not change the state of any Resource or the Printer itself.

1224 **6.1.5.1 Get-Printer-Resources Request**

1225 The following groups of attributes are part of a Get-Printer-Resources request.

1226 Group 1: Operation Attributes

1227 “attributes-charset” (charset) and

1228 “attributes-natural-language” (naturalLanguage):

1229 The Client MUST supply and the Printer MUST support both of these
1230 attributes.

1231 “printer-uri” (uri):

1232 The Client MUST supply and the Printer MUST support the “printer-uri”
1233 operation attribute which is the target Printer for the operation.

1234 “resource-ids (1setOf (integer(1:MAX)))”:

- 1235 The Client MAY supply and the Printer MUST support the “resource-ids”
1236 operation attribute which is the list of target Resources for the operation.
- 1237 "requesting-user-name" (name(MAX)) and
1238 "requesting-user-uri" (uri) and
1239 "requesting-user-vcard" (1setOf text(MAX)):
- 1240 The Client SHOULD supply and the Printer MUST support all three of these
1241 attributes.
- 1242 “first-index” (integer(1:MAX)):
- 1243 The Client MAY supply and the Printer MUST support this attribute.
- 1244 "limit" (integer(1:MAX)):
- 1245 The Client MAY supply and the Printer MUST support this attribute.
- 1246 “requested-attributes” (1setOf type2 keyword):
- 1247 The Client MAY supply and the Printer MUST support this attribute. If this
1248 operation attribute is NOT supplied, then the System MUST only return the
1249 value of the equivalent “system-configured-resources” entry for each
1250 selected Resource. See section “system-configured-resources” in section 7.3
1251 System Status Attributes.
- 1252 "resource-formats" (1setOf (mimeMediaType)):
- 1253 The Client MAY supply and the Printer MUST support this attribute. If this
1254 operation attribute is supplied, then the Printer MUST return the attributes
1255 and values for the selected Resources. See “resource-format” in section 7.7
1256 Resource Status Attributes.
- 1257 “resource-states” (1setOf (type1 enum)):
- 1258 The Client MAY supply and the Printer MUST support this attribute. If this
1259 operation attribute is supplied, then the Printer MUST return the attributes
1260 and values for the selected Resources. See “resource-state” in section 7.7
1261 Resource Status Attributes.
- 1262 “resource-types” (1setOf (type2 keyword)):
- 1263 The Client MAY supply and the Printer MUST support this attribute. If this
1264 operation attribute is supplied, then the Printer MUST return the attributes
1265 and values for the selected Resources. See “resource-type” in section 7.7
1266 Resource Status Attributes.

6.1.5.2 Get-Printer-Resources Response

The following groups of attributes are part of a Get-Printer-Resources response. The Printer returns a Get-Printer-Resources operation response to the Client up to the number specified by the “limit” operation attribute that match the filter criteria as supplied by the Client in the request.

Group 1: Operation Attributes

“attributes-charset” (charset) and
“attributes-natural-language” (naturalLanguage):

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

“status-message” (text(255)) and/or
“detailed-status-message” (text(MAX)):

The Printer MAY return one or both of these attributes.

Group 2: Unsupported Attributes

See [RFC8011] for details on returning Unsupported Attributes.

Groups 3 to N: Resource Attributes

See [RFC8011] for details on returning analogous Printer Attributes.

“resource-id” (integer(1:MAX)):

The Printer MUST return this attribute.

“resource-uuid” (uri(45)):

The Printer MUST return this attribute.

“resource-state” (type1 enum) and
“resource-state-reasons” (1setOf type2 keyword):

The Printer MUST return both of these attributes.

6.1.6 Shutdown-One-Printer

This REQUIRED operation allows an authorized Operator or Administrator to shutdown one configured Printer object (i.e., Job processing service) on the target System object.

This operation is semantically equivalent to the ShutdownService operation defined in [PWG5108.06]. This operation is also semantically equivalent to a Shutdown-Printer

1296 operation [RFC3998] to the configured Printer object (except for the resulting “printer-state”
1297 of ‘stopped’ rather than ‘idle’).

1298 If accepted, the System MUST shutdown the specified Printer with the “printer-state” set to
1299 ‘stopped’ (i.e., no Jobs can be processed and intervention is required) and the ‘shutdown’
1300 value added to “printer-state-reasons”. This operation MAY cause the System to pause with
1301 “system-state” set to ‘stopped’ (if all other Printers already had a “printer-state” of ‘stopped’).

1302 The Client can later send a Startup-One-Printer operation to the System (preferred) or a
1303 Startup-Printer operation [RFC3998] to the Printer to start up the specified Printer.

1304 **6.1.6.1 Shutdown-One-Printer Request**

1305 The following groups of attributes are part of a Shutdown-One-Printer request.

1306 Group 1: Operation Attributes

1307 "attributes-charset" (charset) and
1308 "attributes-natural-language" (naturalLanguage):

1309 The Client MUST supply and the System MUST support both of these
1310 attributes.

1311 “system-uri” (uri):

1312 The Client MUST supply and the System MUST support the “system-uri”
1313 operation attribute which is the target System for the operation.

1314 “printer-id” (integer(1:65535)):

1315 The Client MUST supply and the System MUST support the “printer-id”
1316 operation attribute which is the target Printer for the operation.

1317 "requesting-user-name" (name(MAX)) and
1318 "requesting-user-uri" (uri) and
1319 "requesting-user-vcard" (1setOf text(MAX)):

1320 The Client SHOULD supply and the System MUST support all three of these
1321 attributes.

1322 “printer-message-from-operator” (text(127)):

1323 The Client MAY supply and the System MUST support this attribute.

1324 **6.1.6.2 Shutdown-One-Printer Response**

1325 The following groups of attributes are part of a Shutdown-One-Printer response.

1326 Group 1: Operation Attributes

1327 "attributes-charset" (charset) and
1328 "attributes-natural-language" (naturalLanguage):

1329 The System MUST return both of these attributes.

1330 "status-message" (text(255)) and/or
1331 "detailed-status-message" (text(MAX)):

1332 The System MAY return one or both of these attributes.

1333 Group 2: Unsupported Attributes

1334 See [RFC8011] for details on returning Unsupported Attributes.

1335 Group 3: Printer Attributes

1336 See [RFC8011] for details on returning Printer Attributes.

1337 "printer-id" (integer(1:65535)):

1338 The System MUST return this attribute for the target Printer.

1339 "printer-uuid" (uri(45)):

1340 The System MUST return this attribute for the target Printer.

1341 "printer-xri-supported" (1setOf collection):

1342 The System MUST return this attribute for the target Printer.

1343 "printer-state" (type1 enum) and
1344 "printer-state-reasons" (1setOf type2 keyword) and
1345 "printer-is-accepting-jobs" (boolean):

1346 The System MUST return all three of these attributes for the target Printer.

1347 **6.1.7 Startup-One-Printer**

1348 This REQUIRED operation allows an authorized Operator or Administrator to startup one
1349 configured Printer object (i.e., Job processing service) on the target System object.

1350 This operation is semantically equivalent to the StartupService operation defined in
1351 [PWG5108.06].

1352 If accepted, the System MUST start the specified Printer with the "printer-state" set to
1353 'stopped' (i.e., no Jobs can be processed and intervention is required), "printer-is-accepting-
1354 jobs" set to 'false' (i.e., no incoming Jobs accepted), and the 'paused' value added to "printer-

1355 state-reasons” (i.e., no Job processing output allowed). This operation MAY cause the
1356 System to resume with “system-state” set to ‘idle’ (if all other Printers already had a “printer-
1357 state” of ‘stopped’).

1358 The Client can later send one or more Set-Printer-Attributes operations to modify the
1359 configuration of the Printer, followed by Resume-Printer (i.e., remove ‘paused’ from “printer-
1360 state-reasons”) and Enable-Printer (i.e., change “printer-is-accepting-jobs” to ‘true’) to
1361 change the “printer-state” to ‘idle’ (unless there is another reason for the Printer to stay in
1362 the ‘stopped’ state).

1363 **6.1.7.1 Startup-One-Printer Request**

1364 The following groups of attributes are part of a Startup-One-Printer request.

1365 Group 1: Operation Attributes

1366 "attributes-charset" (charset) and
1367 "attributes-natural-language" (naturalLanguage):

1368 The Client MUST supply and the System MUST support both of these
1369 attributes.

1370 “system-uri” (uri):

1371 The Client MUST supply and the System MUST support the “system-uri”
1372 operation attribute which is the target System for the operation.

1373 “printer-id” (integer(1:65535)):

1374 The Client MUST supply and the System MUST support the “printer-id”
1375 operation attribute which is the target Printer for the operation.

1376 "requesting-user-name" (name(MAX)) and
1377 "requesting-user-uri" (uri) and
1378 “requesting-user-vcard” (1setOf text(MAX)):

1379 The Client SHOULD supply and the System MUST support all three of these
1380 attributes.

1381 “printer-message-from-operator” (text(127)):

1382 The Client MAY supply and the System MUST support this attribute.

1383 **6.1.7.2 Startup-One-Printer Response**

1384 The following groups of attributes are part of a Startup-One-Printer response.

1385 Group 1: Operation Attributes

1386 "attributes-charset" (charset) and
1387 "attributes-natural-language" (naturalLanguage):

1388 The System MUST return both of these attributes.

1389 "status-message" (text(255)) and/or
1390 "detailed-status-message" (text(MAX)):

1391 The System MAY return one or both of these attributes.

1392 Group 2: Unsupported Attributes

1393 See [RFC8011] for details on returning Unsupported Attributes.

1394 Group 3: Printer Attributes

1395 See [RFC8011] for details on returning Printer Attributes.

1396 "printer-id" (integer(1:65535)):

1397 The System MUST return this attribute for the target Printer.

1398 "printer-uuid" (uri(45)):

1399 The System MUST return this attribute for the target Printer.

1400 "printer-xri-supported" (1setOf collection):

1401 The System MUST return this attribute for the target Printer.

1402 "printer-state" (type1 enum) and
1403 "printer-state-reasons" (1setOf type2 keyword) and
1404 "printer-is-accepting-jobs" (boolean):

1405 The System MUST return all three of these attributes for the target Printer.

1406 6.2 Resource Operations

1407 IPP System Service operations on single Resource objects (except for Get-Resources) are
1408 defined in this section.

1409 6.2.1 Cancel-Resource

1410 This REQUIRED operation allows an authorized Operator or Administrator to cancel an
1411 existing Resource object on the target System object. If the Resource object's "resource-
1412 state" is 'canceled' or 'aborted' or "resource-state-reasons" includes 'cancel-requested', then
1413 the System MUST return a "status-code" of 'client-error-not-possible'.

1414 This operation is semantically analogous to the DeleteResource operation defined in
1415 [PWG5108.03] (except that the Resource is not removed, in order to preserve the integrity of
1416 system log files). See section 4.6. Resource Object and section 4.6.1 Resource History for
1417 more details.

1418 If accepted, the System MUST set the “resource-state” to ‘canceled’ or leave “resource-
1419 state” unchanged and add ‘cancel-requested’ to “resource-state-reasons” (e.g., if the
1420 Resource is currently in use by a Job). In either case, the System MUST make the Resource
1421 permanently unavailable for future use. The System MUST preserve all Resource object
1422 attributes for an implementation-defined Resource History period.

1423 When “resource-state” eventually transitions to ‘canceled’, the System SHOULD delete any
1424 local copy of Resource data. This operation does not change the “system-state” of the
1425 System itself.

1426 **6.2.1.1 Cancel-Resource Request**

1427 The following groups of attributes are part of a Cancel-Resource request.

1428 Group 1: Operation Attributes

1429 "attributes-charset" (charset) and
1430 "attributes-natural-language" (naturalLanguage):

1431 The Client MUST supply and the System MUST support both of these
1432 attributes.

1433 “system-uri” (uri):

1434 The Client MUST supply and the System MUST support the “system-uri”
1435 operation attribute which is the target System for the operation.

1436 “resource-id” (integer(1:MAX)):

1437 The Client MUST supply and the System MUST support this attribute which
1438 is the target Resource for the operation.

1439 "requesting-user-name" (name(MAX)) and
1440 "requesting-user-uri" (uri) and
1441 “requesting-user-vcard” (1setOf text(MAX)):

1442 The Client SHOULD supply and the System MUST support all three of these
1443 attributes.

1444 **6.2.1.2 Cancel-Resource Response**

1445 The following groups of attributes are part of a Cancel-Resource response.

1446 Group 1: Operation Attributes

1447 "attributes-charset" (charset) and
1448 "attributes-natural-language" (naturalLanguage):

1449 The System MUST return both of these attributes.

1450 "status-message" (text(255)) and/or
1451 "detailed-status-message" (text(MAX)):

1452 The System MAY return one or both of these attributes.

1453 Group 2: Unsupported Attributes

1454 See [RFC8011] for details on returning Unsupported Attributes.

1455 **6.2.2 Create-Resource-Subscriptions**

1456 This REQUIRED operation allows an authorized Operator or Administrator to create one or
1457 more System Subscription objects on Resources.

1458 This operation is semantically analogous to the Create-Job-Subscriptions operation defined
1459 in [RFC3995].

1460 The Client supplies one or more Subscription Attributes groups, each containing one or more
1461 of the Subscription Template Attributes defined in section 5.3 Table 1 of [RFC3995]. The
1462 System MUST support all of the Subscription Template Attributes defined in section 5.3
1463 Table 1 of [RFC3995]. If the Resource object's "resource-state" is 'canceled' or 'aborted' or
1464 "resource-state-reasons" includes 'cancel-requested', then the System MUST return a
1465 "status-code" of 'client-error-not-possible'.

1466 If accepted, the System MUST create the requested Subscription objects. This operation
1467 does not change the state of the System itself.

1468 **6.2.2.1 Create-Resource-Subscriptions Request**

1469 The following groups of attributes are part of a Create-Resource-Subscriptions request.

1470 Group 1: Operation Attributes

1471 "attributes-charset" (charset) and
1472 "attributes-natural-language" (naturalLanguage):

1473 The Client MUST supply and the System MUST support both of these
1474 attributes.

1475 "system-uri" (uri):

1476 The Client MUST supply and the System MUST support the "system-uri"
1477 operation attribute which is the target System for the operation.

1478 "resource-id" (integer(1:MAX)):

1479 The Client MUST supply and the System MUST support this attribute which
1480 is the target Resource for the operation.

1481 "requesting-user-name" (name(MAX)) and
1482 "requesting-user-uri" (uri) and
1483 "requesting-user-vcard" (1setOf text(MAX)):

1484 The Client SHOULD supply and the System MUST support all three of these
1485 attributes.

1486 Groups 2-N: Subscription Attributes

1487 See [RFC3995] for details on supplying Subscription Attributes.

1488 6.2.2.2 Create-Resource-Subscriptions Response

1489 The following groups of attributes are part of a Create-Resource-Subscriptions response.

1490 Group 1: Operation Attributes

1491 "attributes-charset" (charset) and
1492 "attributes-natural-language" (naturalLanguage):

1493 The System MUST return both of these attributes.

1494 "status-message" (text(255)) and/or
1495 "detailed-status-message" (text(MAX)):

1496 The System MAY return one or both of these attributes.

1497 Group 2: Unsupported Attributes

1498 See [RFC8011] for details on returning Unsupported Attributes.

1499 Groups 3-N: Subscription Attributes

1500 See [RFC3995] for details on returning Subscription Attributes.

1501 6.2.3 Get-Resource-Attributes

1502 This REQUIRED operation allows an authorized Operator or Administrator to retrieve some
1503 or all of the attributes the target Resource object. For Resources, the possible names of
1504 attribute groups for the "requested-attributes" operation attribute are:

1505 'resource-description': The subset of Resource Description attributes.

1506 'resource-status': The subset of Resource Status attributes.

1507 'all': All Resource attributes.

1508 This operation is semantically equivalent to the GetResourceElements operation defined in
1509 [PWG5108.03]. This operation is also semantically analogous the Get-Job-Attributes and
1510 Get-Printer-Attributes operations defined in [RFC8011].

1511 If accepted, the System MUST return the requested attributes for the selected Resource
1512 object. This operation does not change the state of any Resource or the System itself.

1513 **6.2.3.1 Get-Resource-Attributes Request**

1514 The following groups of attributes are part of a Get-Resource-Attributes request.

1515 Group 1: Operation Attributes

1516 "attributes-charset" (charset) and
1517 "attributes-natural-language" (naturalLanguage):

1518 The Client MUST supply and the System MUST support both of these
1519 attributes.

1520 "system-uri" (uri):

1521 The Client MUST supply and the System MUST support the "system-uri"
1522 operation attribute which is the target System for the operation.

1523 "resource-id (integer(1:MAX))):

1524 The Client MUST supply and the System MUST support the "resource-id"
1525 operation attribute which is the target Resource for the operation.

1526 "requesting-user-name" (name(MAX)) and
1527 "requesting-user-uri" (uri) and
1528 "requesting-user-vcard" (1setOf text(MAX)):

1529 The Client SHOULD supply and the System MUST support all three of these
1530 attributes.

1531 "requested-attributes" (1setOf type2 keyword):

1532 The Client MAY supply and the System MUST support this attribute. If this
1533 operation attribute is NOT supplied, then the System MUST only return the
1534 value of the "system-configured-resources" entry for each selected

1535 Resource. See section “system-configured-resources” in section 7.3 System
1536 Status Attributes.

1537 **6.2.3.2 Get-Resource-Attributes Response**

1538 The following groups of attributes are part of a Get-Resource-Attributes response.

1539 Group 1: Operation Attributes

1540 "attributes-charset" (charset) and
1541 "attributes-natural-language" (naturalLanguage):

1542 The System MUST return both of these attributes.

1543 "status-message" (text(255)) and/or
1544 "detailed-status-message" (text(MAX)):

1545 The System MAY return one or both of these attributes.

1546 Group 2: Unsupported Attributes

1547 See [RFC8011] for details on returning Unsupported Attributes.

1548 Group 3: Resource Attributes

1549 See [RFC8011] for details on returning analogous Printer Attributes.

1550 “resource-id” (integer(1:MAX)):

1551 The System MUST return this attribute.

1552 “resource-uuid” (uri(45)):

1553 The System MUST return this attribute.

1554 “resource-state” (type1 enum) and
1555 “resource-state-reasons” (1setOf type2 keyword):

1556 The System MUST return both of these attributes.

1557 **6.2.4 Install-Resource**

1558 This REQUIRED operation allows an authorized Operator or Administrator to install an
1559 existing Resource object for use on the target System object.

1560 This operation is semantically analogous to the StoreResource operation defined in
1561 [PWG5108.03] (except that the Resource object is separately created with a previous Create-
1562 Resource operation and Resource data is separately uploaded with a previous Send-Resource-
1563 Data operation).

1564 If the Resource object's "resource-state" is not 'available' or "resource-state-reasons"
1565 includes 'install-requested', then the System MUST return a "status-code" of 'client-error-
1566 not-possible'. The System MUST validate any Resource signature supplied in a previous
1567 Send-Resource-Data operation or embedded in the Resource data, for example as
1568 described in US NIST Digital Signature Standard [FIPS186-4], ENISA Algorithms, Key Size
1569 and Parameters Report [ENISAALG], ETSI Electronic Signatures and Infrastructures (ESI)
1570 Signature validation procedures and policies [TS102853], and IETF XML-Signature Syntax
1571 and Processing [RFC3275]. The System MUST validate the Resource format and type. The
1572 System SHOULD validate the

1573 If accepted, the System MUST set the "resource-state" to 'installed' or leave "resource-state"
1574 unchanged and add 'install-requested' to "resource-state-reasons" (e.g., if this is an
1575 executable Resource and requires a System reboot to complete the installation). This
1576 operation does not change the "system-state" of the System itself.

1577 See section 4.6 Resource Object and section 4.6.1 Resource History for more details.

1578 **6.2.4.1 Install-Resource Request**

1579 The following groups of attributes are part of an Install-Resource request.

1580 Group 1: Operation Attributes

1581 "attributes-charset" (charset) and
1582 "attributes-natural-language" (naturalLanguage):

1583 The Client MUST supply and the System MUST support both of these
1584 attributes.

1585 "system-uri" (uri):

1586 The Client MUST supply and the System MUST support the "system-uri"
1587 operation attribute which is the target System for the operation.

1588 "resource-id" (integer(1:MAX)):

1589 The Client MUST supply and the System MUST support this attribute which
1590 is the target Resource for the operation.

1591 "requesting-user-name" (name(MAX)) and
1592 "requesting-user-uri" (uri) and
1593 "requesting-user-vcard" (1setOf text(MAX)):

1594 The Client SHOULD supply and the System MUST support all three of these
1595 attributes.

6.2.4.2 Install-Resource Response

The following groups of attributes are part of an Install-Resource response.

Group 1: Operation Attributes

"attributes-charset" (charset) and
"attributes-natural-language" (naturalLanguage):

The System MUST return both of these attributes.

"status-message" (text(255)) and/or
"detailed-status-message" (text(MAX)):

The System MAY return one or both of these attributes.

Group 2: Unsupported Attributes

See [RFC8011] for details on returning Unsupported Attributes.

Group 3: Resource Object Attributes

This is the same set of attributes described in the Create-Resource response in section 6.2.2.1.

6.2.5 Send-Resource-Data

This REQUIRED operation allows an authorized Operator or Administrator to upload Resource data for an existing Resource object on the target System object.

This operation is semantically analogous to the StoreResource operation defined in [PWG5108.03] (except that the Resource object is separately created with a previous Create-Resource operation and Resource is separately installed with a subsequent Install-Resource-Data operation).

If the Resource object's "resource-state" is not 'pending', then the System MUST return a "status-code" of 'client-error-not-possible'. The System SHOULD validate any Resource signature supplied or embedded in the Resource data - see section 12.5 for recommendations. The System SHOULD validate the Resource format and type. The System SHOULD validate the Resource data contents.

If accepted, the System MUST set the "resource-state" to 'available'. This operation does not change the "system-state" of the System itself.

This operation is semantically analogous to the Send-Document operation defined in [RFC8011] and semantically analogous to the StoreResource operation defined in [PWG5108.03] (except that the Resource object is separately created with a previous Create-

1627 Resource operation and installed for use with a subsequent Install-Resource operation). See
1628 section 4.6 Resource Object and section 4.6.1 Resource History for more details.

1629 **6.2.5.1 Send-Resource-Data Request**

1630 The following groups of attributes are part of a Send-Resource-Data request.

1631 Group 1: Operation Attributes

1632 "attributes-charset" (charset) and
1633 "attributes-natural-language" (naturalLanguage):

1634 The Client MUST supply and the System MUST support both of these
1635 attributes.

1636 "system-uri" (uri):

1637 The Client MUST supply and the System MUST support the "system-uri"
1638 operation attribute which is the target System for the operation.

1639 "resource-id" (integer(1:MAX)):

1640 The Client MUST supply and the System MUST support this attribute which
1641 is the target Resource for the operation.

1642 "requesting-user-name" (name(MAX)) and
1643 "requesting-user-uri" (uri) and
1644 "requesting-user-vcard" (1setOf text(MAX)):

1645 The Client SHOULD supply and the System MUST support all three of these
1646 attributes.

1647 "resource-format" (mimeType):

1648 The Client MUST supply and the System MUST support this attribute.

1649 "resource-signature" (1setOf octetString):

1650 The Client MAY supply and the System MUST support this attribute which is
1651 the out-of-band digital signature for the Resource data.

1652 Group 2: Resource Content

1653 The Client MUST supply the Resource data.

1654 **6.2.5.2 Send-Resource-Data Response**

1655 The following groups of attributes are part of a Send-Resource-Data response.

1656 Group 1: Operation Attributes

1657 "attributes-charset" (charset) and
1658 "attributes-natural-language" (naturalLanguage):

1659 The System MUST return both of these attributes.

1660 "status-message" (text(255)) and/or
1661 "detailed-status-message" (text(MAX)):

1662 The System MAY return one or both of these attributes.

1663 Group 2: Unsupported Attributes

1664 See [RFC8011] for details on returning Unsupported Attributes.

1665 Group 3: Resource Object Attributes

1666 This is the same set of attributes described in the Create-Resource response in
1667 section 6.2.2.1.

1668 **6.2.6 Set-Resource-Attributes**

1669 This REQUIRED operation allows an authorized Operator or Administrator to set the values
1670 of Resource Description attributes listed in "resource-settable-attributes-supported" (see
1671 section 7.2). For Client support for localization see "system-strings-languages-supported"
1672 and "system-strings-uri" in section 7.2. If one or more of the supplied
1673 Resource Description attributes and/or values are not actually settable, then the System
1674 MUST reject the entire request, indicating which attributes and/or values cannot be set, and
1675 return a "status-code" of 'client-error-not-possible'. If the Resource object's "resource-state"
1676 is either 'canceled' or 'aborted' or "resource-state-reasons" contains 'cancel-requested', then
1677 the System MUST reject the entire request and return a "status-code" of 'client-error-not-
1678 possible'. See additional validation rules in section 4.1 Set-Printer-Attributes of [RFC3380].

1679 This operation is semantically equivalent to the SetResourceElements operation defined in
1680 [PWG5108.03] and semantically analogous to the Set-Printer-Attributes operation defined
1681 in [RFC3380].

1682 If accepted, the System MUST set every supplied Resource Description attribute to exactly
1683 the supplied value. The System MUST NOT partially set a subset of the supplied attributes.
1684 The System MUST accept this operation when the supplied attributes are valid and the value
1685 of "resource-state" (see section 7.7) is 'installed'. The System SHOULD accept this
1686 operation when the supplied attributes are valid and the value of "resource-state" (see
1687 section 7.3) is either 'pending' or 'available'. This operation does not change the "system-
1688 state" of the System itself.

6.2.6.1 Set-Resource-Attributes Request

The following groups of attributes are part of a Set-Resource-Attributes request.

Group 1: Operation Attributes

"attributes-charset" (charset) and
"attributes-natural-language" (naturalLanguage):

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

"system-uri" (uri):

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

"resource-id (integer(1:MAX))):

The Client MUST supply and the System MUST support the "resource-id" operation attribute which is the target Resource for the operation.

"requesting-user-name" (name(MAX)) and
"requesting-user-uri" (uri) and
"requesting-user-vcard" (1setOf text(MAX)):

The Client SHOULD supply and the System MUST support all three of these attributes.

Group 2: Resource Attributes

The IPP Client MUST supply a set of Resource attributes with one or more values (including explicitly allowed out-of-band values) as defined in [RFC8011] and section 7.2 of this document.

See [RFC3380] for details on setting analogous Printer Attributes.

6.2.6.2 Set-Resource-Attributes Response

The following groups of attributes are part of a Set-Resource-Attributes response.

Group 1: Operation Attributes

"attributes-charset" (charset) and
"attributes-natural-language" (naturalLanguage):

The System MUST return both of these attributes.

1718 "status-message" (text(255)) and/or
1719 "detailed-status-message" (text(MAX)):

1720 The System MAY return one or both of these attributes.

1721 Group 2: Unsupported Attributes

1722 See [RFC8011] for details on returning Unsupported Attributes.

1723 Group 3: Resource Attributes

1724 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

1725 "resource-id" (integer(1:MAX)):

1726 The System MUST return this attribute.

1727 "resource-uuid" (uri(45)):

1728 The System MUST return this attribute.

1729 "resource-state" (type1 enum) and
1730 "resource-state-reasons" (1setOf type2 keyword):

1731 The System MUST return both of these attributes.

1732 6.3 System Operations

1733 IPP System Service operations on single System objects or multiple Printer objects are
1734 defined in this section.

1735 Note: The System MUST copy the value of any supplied "system-message-from-operator"
1736 operation attribute to "printer-message-from-operator" for any affected Printer objects (for
1737 [Disable, Enable, Pause, Resume, Shutdown, Startup]All-Printers, Pause-All-Printers-After-
1738 Current-Job, and Restart-System.

1739 6.3.1 Create-Printer

1740 This REQUIRED operation allows an authorized Operator or Administrator to create a new
1741 Printer object (i.e., Job processing service) on the target System object and optionally also
1742 create one or more new per-Printer Subscription objects.

1743 This operation is semantically equivalent to the Create operation for a Printer object defined
1744 in ISO "Document Printing Application (DPA) Part 3: Management Abstract Service Definition
1745 and Procedures" [ISO10175-3] (where a newly created Printer object had the special initial state
1746 of 'unknown', which is NOT defined or used in this specification). This operation is semantically
1747 analogous to the Create-Job operation defined in [RFC8011].

1748 If accepted, the System MUST create and initialize a new Printer object with the “printer-
1749 state” set to ‘stopped’ (i.e., no Jobs can be processed and intervention is required), “printer-
1750 is-accepting-jobs” set to ‘false’ (i.e., no incoming Jobs accepted), and the ‘paused’ value
1751 added to “printer-state-reasons” (i.e., no Job processing output allowed). This operation
1752 does not change the “system-state” of the System itself.

1753 One or more per-Printer Subscription objects can also be created. The Client can then send
1754 one or more Set-Printer-Attributes operations to modify the configuration of the Printer,
1755 followed by Resume-Printer (to remove ‘paused’ from “printer-state-reasons”) and Enable-
1756 Printer (to change “printer-is-accepting-jobs” to ‘true’) to change “printer-state” to ‘idle’
1757 (unless there is another reason for the Printer to stay in the ‘stopped’ state).

1758 Note: When the first Print Service is created on a System, the System MUST set the value
1759 of “system-default-printer-id” to reference that Print Service.

1760 Note: Printer-scope Resource objects MAY be:

- 1761 1. Created **before** the related Create-Printer operation and then associated with a
1762 given Printer using a Create-Printer operation via the “resource-ids” operation
1763 attribute to update the “printer-resource-ids” Printer Status attribute;
- 1764 2. Created **after** the related Create-Printer operation and then associated with a
1765 given Printer using an Allocate-Printer-Resources operation via the “resource-
1766 ids” operation attribute to update the “printer-resource-ids” Printer Status
1767 attribute; or
- 1768 3. Created **after** the related Create-Printer operation and then associated with a
1769 given Printer using an HTTP PUT request [RFC7230] as defined in section 4.1.9
1770 Resources of IPP Shared Infrastructure Extensions [PWG5100.18] to update the
1771 “printer-resource-ids” Printer Status attribute.

1772 Note: Printer-scope Subscription objects MUST be created after the related Create-Printer
1773 operation, so that “notify-printer-id” can be correctly specified.

1774 Note: Appropriate Subunits are automatically associated with a new Printer object based
1775 on “printer-service-type”, inherent System capabilities, (out-of-band) System policies.
1776 Subunits are also associated by configured service capabilities (e.g., “sides-supported” and
1777 duplexer, “finishings-supported” and finishers, “print-color-mode-supported” and colorants, etc.
1778 – association by intent and not by explicit identification/listing of Subunits.

1779 6.3.1.1 Create-Printer Request

1780 The following groups of attributes are part of a Create-Printer request.

1781 Group 1: Operation Attributes

1782 "attributes-charset" (charset) and
1783 "attributes-natural-language" (naturalLanguage):

1784 The Client MUST supply and the System MUST support both of these
1785 attributes.

1786 “system-uri” (uri):

1787 The Client MUST supply and the System MUST support the “system-uri”
1788 operation attribute which is the target System for the operation.

1789 "requesting-user-name" (name(MAX)) and
1790 "requesting-user-uri" (uri) and
1791 "requesting-user-vcard" (1setOf text(MAX)):

1792 The Client SHOULD supply and the System MUST support all three of these
1793 attributes.

1794 “printer-service-type” (type2 keyword):

1795 The Client MUST supply and the System MUST support this attribute.

1796 “printer-message-from-operator” (text(127)):

1797 The Client MAY supply and the System MUST support this attribute.

1798 "printer-xri-requested" (1setOf collection):

1799 The Client MAY supply and the System MUST support this attribute.

1800 “resource-ids” (1setOf integer(1:MAX)):

1801 The Client MAY supply and the System MUST support this attribute.

1802 Group 2: Printer Description Attributes

1803 <all mandatory Printer Description attributes>

1804 The Client MUST supply and the System MUST support all of the attributes
1805 listed in “system-mandatory-printer-attributes”

1806 <any other Printer Description attribute>

1807 The Client MAY supply and the System MUST support all of the attributes
1808 listed in “printer-creation-attributes-supported”

1809 Groups 3-N: Subscription Attributes

1810 See [RFC3995] for details on supplying Subscription Attributes.

1811 6.3.1.2 Create-Printer Response

1812 The following groups of attributes are part of a Create-Printer response.

1813 Group 1: Operation Attributes

1814 "attributes-charset" (charset) and
1815 "attributes-natural-language" (naturalLanguage):

1816 The System MUST return both of these attributes.

1817 "status-message" (text(255)) and/or
1818 "detailed-status-message" (text(MAX)):

1819 The System MAY return one or both of these attributes.

1820 Group 2: Unsupported Attributes

1821 See [RFC8011] for details on returning Unsupported Attributes.

1822 Groups 3: Printer Attributes

1823 See [RFC8011] for details on returning Printer Attributes.

1824 "printer-id" (integer(1:65535)):

1825 The System MUST return this attribute.

1826 "printer-uuid" (uri(45)):

1827 The System MUST return this attribute.

1828 "printer-xri-supported" (1setOf collection)

1829 The System MUST return this attribute.

1830 "printer-state" (type1 enum) and
1831 "printer-state-reasons" (1setOf type2 keyword) and
1832 "printer-is-accepting-jobs" (boolean):

1833 The System MUST return all three of these attributes.

1834 Groups 4-N: Subscription Attributes

1835 See [RFC3995] for details on returning Subscription Attributes.

1836 Group N+1: System Attributes

1837 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

1838 “system-uuid” (uri(45)):

1839 The System MUST return this attribute.

1840 “system-xri-supported” (1setOf collection)

1841 The System MUST return this attribute.

1842 “system-state” (type1 enum) and

1843 “system-state-reasons” (1setOf type2 keyword):

1844 The System MUST return both of these attributes.

1845 6.3.2 Create-Resource

1846 This REQUIRED operation allows an authorized Operator or Administrator to create a new
1847 Resource object on the target System object and optionally also create one or more new
1848 per-Resource Subscription objects.

1849 This operation is semantically analogous to the StoreResource operation defined in
1850 [PWG5108.03] (except that the Resource data is separately transferred with a subsequent Send-
1851 Resource-Data operation and installed for use with a subsequent Install-Resource operation).

1852 If accepted, the System MUST create and initialize a new Resource object with the
1853 “resource-state” set to ‘pending’ (i.e., no Resource data has been associated yet). This
1854 operation does not change the “system-state” of the System itself. One or more per-
1855 Resource Subscription objects can also be created. The Client can then use one or more
1856 Set-Resource-Attributes operations to modify the Resource object, followed by a Send-
1857 Resource-Data operation (i.e., upload the associated Resource data) to change the
1858 “resource-state” to ‘available’. During processing of the Send-Resource-Data operation, the
1859 System can keep the “resource-state” of ‘pending’ and also add ‘resource-incoming’ to
1860 “resource-state-reasons” if the upload completion is delayed. The Client can then use an
1861 Install-Resource operation to install the Resource, which will either change “resource-state”
1862 to ‘installed’ or add ‘install-requested’ to “resource-state-reasons”. See section 7.7.12
1863 resource-state for a discussion of Resource object states and lifecycle phases.

1864 Note: The Client MUST use both the Send-Resource-Data and Install-Resource operations
1865 for all “resource-type” values, which simplifies the Resource state machine.

1866 Note: Printer-scope Resource objects MAY be:

- 1867 1. Created **before** the related Create-Printer operation and then associated with a
1868 given Printer using a Create-Printer operation via the “resource-ids” operation
1869 attribute to update the “printer-resource-ids” Printer Status attribute;
- 1870 2. Created **after** the related Create-Printer operation and then associated with a
1871 given Printer using an Allocate-Printer-Resources operation via the “resource-
1872 ids” operation attribute to update the “printer-resource-ids” Printer Status
1873 attribute; or

1874 3. Created **after** the related Create-Printer operation and then associated with a
1875 given Printer using an HTTP PUT request [RFC7230] as defined in section 4.1.9
1876 Resources of IPP Shared Infrastructure Extensions [PWG5100.18] to update the
1877 “printer-resource-ids” Printer Status attribute.

1878 Note: Job-scope Resource objects MUST be created **before** the Job creation operation and
1879 then associated with a given Job via the “resource-ids” Job creation operation attribute to
1880 update the “job-resource-ids” Job Status attribute.

1881 Note: Resource-scope Subscription objects MUST be created **after** the related Create-
1882 Resource operation, so that “notify-resource-id” can be correctly specified.

1883 6.3.2.1 Create-Resource Request

1884 The following groups of attributes are part of a Create-Resource request.

1885 Group 1: Operation Attributes

1886 “attributes-charset” (charset) and
1887 “attributes-natural-language” (naturalLanguage):

1888 The Client MUST supply and the System MUST support both of these
1889 attributes.

1890 “system-uri” (uri):

1891 The Client MUST supply and the System MUST support the “system-uri”
1892 operation attribute which is the target System for the operation.

1893 “requesting-user-name” (name(MAX)) and
1894 “requesting-user-uri” (uri) and
1895 “requesting-user-vcard” (1setOf text(MAX)):

1896 The Client SHOULD supply and the System MUST support all three of these
1897 attributes.

1898 “resource-type” (type2 keyword):

1899 The Client MUST supply and the System MUST support this attribute.

1900 Group 2: Resource Description Attributes

1901 <any Resource Description attribute>

1902 The Client MAY supply and the System MAY support these attributes.

1903 Groups 3-N: Subscription Attributes

1904 See [RFC3995] for details on supplying Subscription Attributes.

1905 **6.3.2.2 Create-Resource Response**

1906 The following groups of attributes are part of a Create-Resource response.

1907 Group 1: Operation Attributes

1908 "attributes-charset" (charset) and
1909 "attributes-natural-language" (naturalLanguage):

1910 The System MUST return both of these attributes.

1911 "status-message" (text(255)) and/or
1912 "detailed-status-message" (text(MAX)):

1913 The System MAY return one or both of these attributes.

1914 "resource-format-accepted" (1setOf mimeType)

1915 This System MUST return this list of accepted Resource formats (for use in
1916 Send-Resource-Data) based on the "resource-type" specified in the Create-
1917 Response request.

1918 Group 2: Unsupported Attributes

1919 See [RFC8011] for details on returning Unsupported Attributes.

1920 Groups 3: Resource Attributes

1921 See [RFC8011] for details on returning analogous Printer Attributes.

1922 "resource-id" (integer(1:MAX)):

1923 The System MUST return this attribute.

1924 "resource-uuid" (uri(45)):

1925 The System MUST return this attribute.

1926 "resource-state" (type1 enum) and
1927 "resource-state-reasons" (1setOf type2 keyword):

1928 The System MUST return both of these attributes.

1929 Groups 4-N: Subscription Attributes

1930 See [RFC3995] for details on returning Subscription Attributes.

1931 **6.3.3 Create-System-Subscriptions**

1932 This REQUIRED operation allows an authorized Operator or Administrator to create one or
1933 more System Subscription objects.

1934 This operation is semantically analogous to the Create-Printer-Subscriptions operation
1935 defined in [RFC3995].

1936 The Client supplies one or more Subscription Attributes groups, each containing one or more
1937 of the Subscription Template Attributes defined in section 5.3 Table 1 of [RFC3995]. The
1938 System MUST support all of the Subscription Template Attributes defined in section 5.3
1939 Table 1 of [RFC3995].

1940 If accepted, the System MUST create the requested Subscription objects. This operation
1941 does not change the state of the System itself.

1942 **6.3.3.1 Create-System-Subscriptions Request**

1943 The following groups of attributes are part of a Create-System-Subscriptions request.

1944 Group 1: Operation Attributes

1945 "attributes-charset" (charset) and
1946 "attributes-natural-language" (naturalLanguage):

1947 The Client MUST supply and the System MUST support both of these
1948 attributes.

1949 "system-uri" (uri):

1950 The Client MUST supply and the System MUST support the "system-uri"
1951 operation attribute which is the target System for the operation.

1952 "requesting-user-name" (name(MAX)) and
1953 "requesting-user-uri" (uri) and
1954 "requesting-user-vcard" (1setOf text(MAX)):

1955 The Client SHOULD supply and the System MUST support all three of these
1956 attributes.

1957 Groups 2-N: Subscription Attributes

1958 See [RFC3995] for details on supplying Subscription Attributes.

1959 **6.3.3.2 Create-System-Subscriptions Response**

1960 The following groups of attributes are part of a Create-System-Subscriptions response.

1961 Group 1: Operation Attributes

1962 "attributes-charset" (charset) and
1963 "attributes-natural-language" (naturalLanguage):

1964 The System MUST return both of these attributes.

1965 "status-message" (text(255)) and/or
1966 "detailed-status-message" (text(MAX)):

1967 The System MAY return one or both of these attributes.

1968 Group 2: Unsupported Attributes

1969 See [RFC8011] for details on returning Unsupported Attributes.

1970 Groups 3-N: Subscription Attributes

1971 See [RFC3995] for details on returning Subscription Attributes.

1972 **6.3.4 Delete-Printer**

1973 This REQUIRED operation allows an authorized Operator or Administrator to delete a Printer
1974 object, i.e., Job processing service, on the target System object.

1975 This operation is semantically equivalent to the Delete operation for a Printer object defined in
1976 ISO "Document Printing Application (DPA) Part 3: Management Abstract Service Definition and
1977 Procedures" [ISO10175-3].

1978 If accepted, the System MUST shutdown the Printer and delete the Printer object from the
1979 System.

1980 Because the Printer may require time to cancel a currently printing Job, the Printer MAY not
1981 be deleted immediately. The System indicates this is the case by adding the 'moving-to-
1982 paused' keyword to the "printer-state-reasons" attribute returned in the response. If the
1983 Printer is deleted immediately, the System returns a value of 'stopped' in the "printer-state"
1984 attribute and 'deleted' in the "printer-state-reasons" attribute in the response.

1985 This operation can change the "system-state" of the System itself depending on the state of
1986 any other Printer objects.

1987 **6.3.4.1 Delete-Printer Request**

1988 The following groups of attributes are part of a Delete-Printer request.

1989 Group 1: Operation Attributes

- 1990 "attributes-charset" (charset) and
1991 "attributes-natural-language" (naturalLanguage):
- 1992 The Client MUST supply and the System MUST support both of these
1993 attributes.
- 1994 "system-uri" (uri) and "printer-id" (integer(1:65535)):
- 1995 The Client MUST supply and the System MUST support the "system-uri" and
1996 "printer-id" operation attributes which specify the target Printer for the
1997 operation.
- 1998 "requesting-user-name" (name(MAX)) and
1999 "requesting-user-uri" (uri) and
2000 "requesting-user-vcard" (1setOf text(MAX)):
- 2001 The Client SHOULD supply and the System MUST support all three of these
2002 attributes.
- 2003 **6.3.4.2 Delete-Printer Response**
- 2004 The following groups of attributes are part of a Delete-Printer response.
- 2005 Group 1: Operation Attributes
- 2006 "attributes-charset" (charset) and
2007 "attributes-natural-language" (naturalLanguage):
- 2008 The System MUST return both of these attributes.
- 2009 "status-message" (text(255)) and/or
2010 "detailed-status-message" (text(MAX)):
- 2011 The System MAY return one or both of these attributes.
- 2012 Group 2: Printer Attributes
- 2013 "printer-state" (type1 enum):
- 2014 The current state of the Printer. A Printer that has been deleted will have the
2015 state 'stopped'.
- 2016 "printer-state-reasons" (1setOf type2 keyword):
- 2017 The current state reasons of the Printer. A Printer that has been deleted will
2018 have a single keyword value of 'deleted' in this attribute. A Printer that is in
2019 the process of being deleted will have a keyword value of 'moving-to-paused'
2020 in this attribute.

2021 Group 3: System Attributes

2022 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2023 “system-uuid” (uri(45)):

2024 The System MUST return this attribute.

2025 “system-xri-supported” (1setOf collection)

2026 The System MUST return this attribute.

2027 “system-state” (type1 enum) and

2028 “system-state-reasons” (1setOf type2 keyword):

2029 The System MUST return both of these attributes.

2030 **6.3.5 Disable-All-Printers**

2031 This REQUIRED operation allows an authorized Operator or Administrator to pause all
2032 configured Printer objects (i.e., Job processing services) on the target System object. If no
2033 Printers are configured on the System, then the System MUST return a “status-code” of
2034 'successful-ok'.

2035 This operation is semantically equivalent to the DisableAllServices operation defined in
2036 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Disable-
2037 Printer operations [RFC3398] to each configured Printer object.

2038 If accepted, the System MUST disable each configured Printer with “printer-is-accepting-
2039 jobs” set to ‘false’ but the value of “printer-state” or “printer-state-reasons” is not affected by
2040 the Disable-All-Printers operation. This operation does not change the System state.

2041 **6.3.5.1 Disable-All-Printers Request**

2042 The following groups of attributes are part of a Disable-All-Printers request.

2043 Group 1: Operation Attributes

2044 “attributes-charset” (charset) and

2045 “attributes-natural-language” (naturalLanguage):

2046 The Client MUST supply and the System MUST support both of these
2047 attributes.

2048 “system-uri” (uri):

2049 The Client MUST supply and the System MUST support the “system-uri”
2050 operation attribute which is the target System for the operation.

2051 "requesting-user-name" (name(MAX)) and
2052 "requesting-user-uri" (uri) and
2053 "requesting-user-vcard" (1setOf text(MAX)):

2054 The Client SHOULD supply and the System MUST support all three of these
2055 attributes.

2056 "system-message-from-operator" (text(127)):

2057 The Client MAY supply and the System MUST support this attribute.

2058 **6.3.5.2 Disable-All-Printers Response**

2059 The following groups of attributes are part of a Disable-All-Printers response.

2060 Group 1: Operation Attributes

2061 "attributes-charset" (charset) and
2062 "attributes-natural-language" (naturalLanguage):

2063 The System MUST return both of these attributes.

2064 "status-message" (text(255)) and/or
2065 "detailed-status-message" (text(MAX)):

2066 The System MAY return one or both of these attributes.

2067 Group 2: Unsupported Attributes

2068 See [RFC8011] for details on returning Unsupported Attributes.

2069 Groups 3-N: Printer Attributes

2070 See [RFC8011] for details on returning Printer Attributes.

2071 "printer-id" (integer(1:65535)):

2072 The System MUST return this attribute.

2073 "printer-uuid" (uri(45)):

2074 The System MUST return this attribute.

2075 "printer-xri-supported" (1setOf collection)

2076 The System MUST return this attribute.

2077 “printer-state” (type1 enum) and
2078 “printer-state-reasons” (1setOf type2 keyword) and
2079 “printer-is-accepting-jobs” (boolean):

2080 The System MUST return all three of these attributes.

2081 **6.3.6 Enable-All-Printers**

2082 This REQUIRED operation allows an authorized Operator or Administrator to enable all
2083 configured Printer objects (i.e., Job processing services) on the target System object. If no
2084 Printers are configured on the System, then the System MUST return a “status-code” of
2085 'successful-ok'.

2086 This operation is semantically equivalent to the EnableAllServices operation defined in
2087 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Enable-
2088 Printer operations [RFC3398] to each configured Printer object.

2089 If accepted, the System MUST enable each configured Printer with “printer-is-accepting-
2090 jobs” set to ‘true’ but the value of “printer-state” or “printer-state-reasons” is not affected by
2091 the Enable-All-Printers operation. This operation does not change the System state.

2092 **6.3.6.1 Enable-All-Printers Request**

2093 The following groups of attributes are part of a Enable-All-Printers request.

2094 Group 1: Operation Attributes

2095 “attributes-charset” (charset) and
2096 “attributes-natural-language” (naturalLanguage):

2097 The Client MUST supply and the System MUST support both of these
2098 attributes.

2099 “system-uri” (uri):

2100 The Client MUST supply and the System MUST support the “system-uri”
2101 operation attribute which is the target System for the operation.

2102 “requesting-user-name” (name(MAX)) and
2103 “requesting-user-uri” (uri) and
2104 “requesting-user-vcard” (1setOf text(MAX)):

2105 The Client SHOULD supply and the System MUST support all three of these
2106 attributes.

2107 “system-message-from-operator” (text(127)):

2108 The Client MAY supply and the System MUST support this attribute.

2109 **6.3.6.2 Enable-All-Printers Response**

2110 The following groups of attributes are part of a Enable-All-Printers response.

2111 Group 1: Operation Attributes

2112 "attributes-charset" (charset) and
2113 "attributes-natural-language" (naturalLanguage):

2114 The System MUST return both of these attributes.

2115 "status-message" (text(255)) and/or
2116 "detailed-status-message" (text(MAX)):

2117 The System MAY return one or both of these attributes.

2118 Group 2: Unsupported Attributes

2119 See [RFC8011] for details on returning Unsupported Attributes.

2120 Groups 3-N: Printer Attributes

2121 See [RFC8011] for details on returning Printer Attributes.

2122 "printer-id" (integer(1:65535)):

2123 The System MUST return this attribute.

2124 "printer-uuid" (uri(45)):

2125 The System MUST return this attribute.

2126 "printer-xri-supported" (1setOf collection)

2127 The System MUST return this attribute.

2128 "printer-state" (type1 enum) and
2129 "printer-state-reasons" (1setOf type2 keyword) and
2130 "printer-is-accepting-jobs" (boolean):

2131 The System MUST return all three of these attributes.

2132 **6.3.7 Get-Resources**

2133 This REQUIRED operation allows an authorized Operator or Administrator to retrieve a
2134 filtered list of some or all of the Resource objects on the target System object. If no
2135 Resources match the specified filter criteria, then the System MUST return a "status-code"
2136 of 'successful-ok'. For Resources, the possible names of attribute groups for the "requested-
2137 attributes" operation attribute are:

2138 'resource-description': The subset of Resource Description attributes.

2139 'resource-status': The subset of Resource Status attributes.

2140 'all': All Resource attributes.

2141 This operation is semantically equivalent to the ListResources operation defined in
2142 [PWG5108.03]. This operation is also semantically analogous the Get-Jobs operation
2143 defined in [RFC8011].

2144 If accepted, the System MUST return the “resource-id” for each matching Resource object.
2145 This operation does not change the state of any Resource or the System itself.

2146 **6.3.7.1 Get-Resources Request**

2147 The following groups of attributes are part of a Get-Resources request.

2148 Group 1: Operation Attributes

2149 "attributes-charset" (charset) and
2150 "attributes-natural-language" (naturalLanguage):

2151 The Client MUST supply and the System MUST support both of these
2152 attributes.

2153 “system-uri” (uri):

2154 The Client MUST supply and the System MUST support the “system-uri”
2155 operation attribute which is the target System for the operation.

2156 “resource-ids (1setOf (integer(1:MAX))):

2157 The Client MAY supply and the System MUST support the “resource-ids”
2158 operation attribute which is the list of target Resources for the operation.

2159 "requesting-user-name" (name(MAX)) and
2160 "requesting-user-uri" (uri) and
2161 “requesting-user-vcard” (1setOf text(MAX)):

2162 The Client SHOULD supply and the System MUST support all three of these
2163 attributes.

2164 “first-index” (integer(1:MAX)):

2165 The Client MAY supply and the System MUST support this attribute.

2166 "limit" (integer(1:MAX)):

2167 The Client MAY supply and the System MUST support this attribute.

2168 “requested-attributes” (1setOf type2 keyword):

2169 The Client MAY supply and the System MUST support this attribute. If this
2170 operation attribute is NOT supplied, then the System MUST only return the
2171 value of the “system-configured-resources” entry for each selected
2172 Resource. See section “system-configured-resources” in section 7.3 System
2173 Status Attributes.

2174 “resource-formats” (1setOf (mimeMediaType)):

2175 The Client MAY supply and the System MUST support this attribute. If this
2176 operation attribute is supplied, then the System MUST return the attributes
2177 and values for the selected Resources. See “resource-format” in section 7.7
2178 Resource Status Attributes.

2179 “resource-states” (1setOf (type1 enum)):

2180 The Client MAY supply and the System MUST support this attribute. If this
2181 operation attribute is supplied, then the System MUST return the attributes
2182 and values for the selected Resources. See “resource-state” in section 7.7
2183 Resource Status Attributes.

2184 “resource-types” (1setOf (type2 keyword)):

2185 The Client MAY supply and the System MUST support this attribute. If this
2186 operation attribute is supplied, then the System MUST return the attributes
2187 and values for the selected Resources. See “resource-type” in section 7.7
2188 Resource Status Attributes.

2189 6.3.7.2 Get-Resources Response

2190 The following groups of attributes are part of a Get-Resources response. The System returns
2191 a Get-Resources operation response to the Client up to the number specified by the “limit”
2192 operation attribute that match the filter criteria as supplied by the Client in the request.

2193 Group 1: Operation Attributes

2194 “attributes-charset” (charset) and
2195 “attributes-natural-language” (naturalLanguage):

2196 The System MUST return both of these attributes, unless no Printers match
2197 the filter criteria specified by the Client.

2198 “status-message” (text(255)) and/or
2199 “detailed-status-message” (text(MAX)):

2200 The System MAY return one or both of these attributes.

2201 Group 2: Unsupported Attributes

2202 See [RFC8011] for details on returning Unsupported Attributes.

2203 Groups 3 to N: Resource Attributes

2204 See [RFC8011] for details on returning analogous Printer Attributes.

2205 “resource-id” (integer(1:MAX)):

2206 The System MUST return this attribute.

2207 “resource-uuid” (uri(45)):

2208 The System MUST return this attribute.

2209 “resource-state” (type1 enum) and

2210 “resource-state-reasons” (1setOf type2 keyword):

2211 The System MUST return both of these attributes.

2212 6.3.8 Get-System-Attributes

2213 This REQUIRED operation allows an authorized Operator or Administrator to retrieve some
2214 or all of the attributes the target System object. For the System, the possible names of
2215 attribute groups for the "requested-attributes" operation attribute are:

2216 'resource-template': The subset of Resource Template attributes.

2217 'system-description': The subset of System Description attributes.

2218 'system-status': The subset of System Status attributes.

2219 'all': All System attributes.

2220 This operation is semantically equivalent to the GetSystemElements operation defined in
2221 [PWG5108.06]. This operation is also semantically analogous the Get-Job-Attributes and
2222 Get-Printer-Attributes operations defined in [RFC8011].

2223 If accepted, the System MUST return the requested attributes for the target System object.

2224 This operation does not change the state of the System itself.

2225 6.3.8.1 Get-System-Attributes Request

2226 The following groups of attributes are part of a Get-System-Attributes request.

2227 Group 1: Operation Attributes

- 2228 "attributes-charset" (charset) and
2229 "attributes-natural-language" (naturalLanguage):
- 2230 The Client MUST supply and the System MUST support both of these
2231 attributes.
- 2232 "system-uri" (uri):
- 2233 The Client MUST supply and the System MUST support the "system-uri"
2234 operation attribute which is the target System for the operation.
- 2235 "requesting-user-name" (name(MAX)) and
2236 "requesting-user-uri" (uri) and
2237 "requesting-user-vcard" (1setOf text(MAX)):
- 2238 The Client SHOULD supply and the System MUST support all three of these
2239 attributes.
- 2240 "requested-attributes" (1setOf type2 keyword):
- 2241 The Client MAY supply and the System MUST support this attribute. If this
2242 operation attribute is NOT supplied, then the System MUST return all of the
2243 System attributes except for "power-[xxx]" (System power details), "system-
2244 configured-printers" and "system-configured-resources". See sections
2245 "power-[xxx]" in section 7.2 System Description Attributes. See also sections
2246 "power-[xxx]", "system-configured-printers" and "system-configured-
2247 resources" in section 7.3 System Status Attributes.

2248 6.3.8.2 Get-System-Attributes Response

2249 The following groups of attributes are part of a Get-System-Attributes response.

2250 Group 1: Operation Attributes

- 2251 "attributes-charset" (charset) and
2252 "attributes-natural-language" (naturalLanguage):
- 2253 The System MUST return both of these attributes.
- 2254 "status-message" (text(255)) and/or
2255 "detailed-status-message" (text(MAX)):
- 2256 The System MAY return one or both of these attributes.
- 2257 Group 2: Unsupported Attributes
- 2258 See [RFC8011] for details on returning Unsupported Attributes.

2259 Group 3: System Attributes

2260 See [RFC8011] for details on returning analogous Printer Attributes.

2261 “system-uuid” (uri(45)):

2262 The System MUST return this attribute.

2263 “system-xri-supported” (1setOf collection)

2264 The System MUST return this attribute.

2265 “system-state” (type1 enum) and

2266 “system-state-reasons” (1setOf type2 keyword):

2267 The System MUST return both of these attributes.

2268 **6.3.9 Get-System-Supported-Values**

2269 This REQUIRED operation allows an authorized Operator or Administrator to request the
2270 values that the System allows in the Set-System-Attributes operation for "xxx-supported"
2271 attributes. For the System, the possible names of attribute groups for the "requested-
2272 attributes" operation attribute are:

2273 'resource-template': The subset of Resource Template attributes.

2274 'system-description': The subset of System Description attributes.

2275 'all': All System attributes.

2276 This operation is semantically analogous to the Get-Printer-Supported-Values operation
2277 defined in [RFC3380].

2278 If accepted, the System MUST return the requested attributes for the target System object.
2279 This operation does not change the state of the System itself.

2280 **6.3.9.1 Get-System-Supported-Values Request**

2281 The following groups of attributes are part of a Get-System-Supported-Values request.

2282 Group 1: Operation Attributes

2283 "attributes-charset" (charset) and

2284 "attributes-natural-language" (naturalLanguage):

2285 The Client MUST supply and the System MUST support both of these
2286 attributes.

2287 “system-uri” (uri):

- 2288 The Client MUST supply and the System MUST support the “system-uri”
2289 operation attribute which is the target System for the operation.
- 2290 "requesting-user-name" (name(MAX)) and
2291 "requesting-user-uri" (uri) and
2292 "requesting-user-vcard" (1setOf text(MAX)):
- 2293 The Client SHOULD supply and the System MUST support all three of these
2294 attributes.
- 2295 "requested-attributes" (1setOf type2 keyword):
- 2296 The Client MAY supply and the System MUST support this attribute. If this
2297 operation attribute is NOT supplied, then the System MUST return all of the
2298 System “xxx-supported” attributes.
- 2299 **6.3.9.2 Get-System-Supported-Values Response**
- 2300 The following groups of attributes are part of a Get-System-Supported-Values response.
- 2301 Group 1: Operation Attributes
- 2302 "attributes-charset" (charset) and
2303 "attributes-natural-language" (naturalLanguage):
- 2304 The System MUST return both of these attributes.
- 2305 "status-message" (text(255)) and/or
2306 "detailed-status-message" (text(MAX)):
- 2307 The System MAY return one or both of these attributes.
- 2308 Group 2: Unsupported Attributes
- 2309 See [RFC8011] for details on returning Unsupported Attributes.
- 2310 Group 3: System Attributes
- 2311 See [RFC8011] for details on returning analogous Printer Attributes.
- 2312 "system-uuid" (uri(45)):
- 2313 The System MUST return this attribute.
- 2314 "system-xri-supported" (1setOf collection)
- 2315 The System MUST return this attribute.

2316 “system-state” (type1 enum) and
2317 “system-state-reasons” (1setOf type2 keyword):

2318 The System MUST return both of these attributes.

2319 **6.3.10 Pause-All-Printers**

2320 This REQUIRED operation allows an authorized Operator or Administrator to pause all
2321 configured Printer objects (i.e., Job processing services) on the target System object. If no
2322 Printers are configured on the System, then the System MUST return a “status-code” of
2323 'successful-ok'.

2324 This operation is semantically equivalent to the PauseAllServices operation defined in
2325 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Pause-
2326 Printer operations [RFC8011] to each configured Printer object.

2327 If accepted, the System MUST pause each configured Printer with the “printer-state” set to
2328 'stopped' and the 'paused' value added to “printer-state-reasons” (unless there is another
2329 reason for the Printer to stay in the 'idle' or 'processing' state, in which case the 'moving-to-
2330 paused' value is added to “printer-state-reasons”). This operation will change the state of
2331 the System itself to 'stopped' when all configured Printers have completed pause and moved
2332 to the 'stopped' state (with the 'moving-to-paused' value removed from their “printer-state-
2333 reasons”).

2334 **6.3.10.1 Pause-All-Printers Request**

2335 The following groups of attributes are part of a Pause-All-Printers request.

2336 Group 1: Operation Attributes

2337 "attributes-charset" (charset) and
2338 "attributes-natural-language" (naturalLanguage):

2339 The Client MUST supply and the System MUST support both of these
2340 attributes.

2341 “system-uri” (uri):

2342 The Client MUST supply and the System MUST support the “system-uri”
2343 operation attribute which is the target System for the operation.

2344 "requesting-user-name" (name(MAX)) and
2345 "requesting-user-uri" (uri) and
2346 “requesting-user-vcard” (1setOf text(MAX)):

2347 The Client SHOULD supply and the System MUST support all three of these
2348 attributes.

2349 “system-message-from-operator” (text(127)):

2350 The Client MAY supply and the System MUST support this attribute.

2351 **6.3.10.2 Pause-All-Printers Response**

2352 The following groups of attributes are part of a Pause-All-Printers response.

2353 Group 1: Operation Attributes

2354 “attributes-charset” (charset) and
2355 “attributes-natural-language” (naturalLanguage):

2356 The System MUST return both of these attributes.

2357 “status-message” (text(255)) and/or
2358 “detailed-status-message” (text(MAX)):

2359 The System MAY return one or both of these attributes.

2360 Group 2: Unsupported Attributes

2361 See [RFC8011] for details on returning Unsupported Attributes.

2362 Groups 3-N: Printer Attributes

2363 See [RFC8011] for details on returning Printer Attributes.

2364 “printer-id” (integer(1:65535)):

2365 The System MUST return this attribute.

2366 “printer-uuid” (uri(45)):

2367 The System MUST return this attribute.

2368 “printer-xri-supported” (1setOf collection)

2369 The System MUST return this attribute.

2370 “printer-state” (type1 enum) and
2371 “printer-state-reasons” (1setOf type2 keyword) and
2372 “printer-is-accepting-jobs” (boolean):

2373 The System MUST return all three of these attributes.

2374 Group N+1: System Attributes

2375 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2376 “system-uuid” (uri(45)):

2377 The System MUST return this attribute.

2378 “system-xri-supported” (1setOf collection)

2379 The System MUST return this attribute.

2380 “system-state” (type1 enum) and

2381 “system-state-reasons” (1setOf type2 keyword):

2382 The System MUST return both of these attributes.

2383 6.3.11 Pause-All-Printers-After-Current-Job

2384 This REQUIRED operation allows an authorized Operator or Administrator to pause all
2385 configured Printer objects (i.e., Job processing services) on the target System object after
2386 all currently processing Jobs have completed (but prevent new Jobs from starting). If no
2387 Printers are configured on the System, then the System MUST return a “status-code” of
2388 'successful-ok'.

2389 This operation is semantically equivalent to the PauseAllServicesAfterCurrentJob operation
2390 defined in [PWG5108.06]. This operation is also semantically equivalent to a sequence of
2391 Pause-Printer operations [RFC8011] to each configured Printer object.

2392 If accepted, the System MUST pause each configured Printer with the “printer-state” set to
2393 ‘stopped’ and the ‘paused’ value added to “printer-state-reasons” (unless there is another
2394 reason for the Printer to stay in the ‘idle’ or ‘processing’ state, in which case the ‘moving-to-
2395 paused’ value is added to “printer-state-reasons”) after all currently Processing Jobs have
2396 completed. This operation will change the state of the System itself to ‘stopped’ when all
2397 configured Printers have completed pause and moved to the ‘stopped’ state (with the ‘moving-
2398 to-paused’ value removed from their “printer-state-reasons”).

2399 6.3.11.1 Pause-All-Printers-After-Current-Job Request

2400 The following groups of attributes are part of a Pause-All-Printers-After-Current-Job request.

2401 Group 1: Operation Attributes

2402 “attributes-charset” (charset) and

2403 “attributes-natural-language” (naturalLanguage):

2404 The Client MUST supply and the System MUST support both of these
2405 attributes.

2406 “system-uri” (uri):

2407 The Client MUST supply and the System MUST support the “system-uri”
2408 operation attribute which is the target System for the operation.

2409 "requesting-user-name" (name(MAX)) and
2410 "requesting-user-uri" (uri) and
2411 "requesting-user-vcard" (1setOf text(MAX)):

2412 The Client SHOULD supply and the System MUST support all three of these
2413 attributes.

2414 “system-message-from-operator” (text(127)):

2415 The Client MAY supply and the System MUST support this attribute.

2416 **6.3.11.2 Pause-All-Printers-After-Current-Job Response**

2417 The following groups of attributes are part of a Pause-All-Printers-After-Current-Job
2418 response.

2419 Group 1: Operation Attributes

2420 "attributes-charset" (charset) and
2421 "attributes-natural-language" (naturalLanguage):

2422 The System MUST return both of these attributes.

2423 "status-message" (text(255)) and/or
2424 "detailed-status-message" (text(MAX)):

2425 The System MAY return one or both of these attributes.

2426 Group 2: Unsupported Attributes

2427 See [RFC8011] for details on returning Unsupported Attributes.

2428 Groups 3-N: Printer Attributes

2429 See [RFC8011] for details on returning Printer Attributes.

2430 “printer-id” (integer(1:65535)):

2431 The System MUST return this attribute.

2432 “printer-uuid” (uri(45)):

2433 The System MUST return this attribute.

2434 “printer-xri-supported” (1setOf collection)

2435 The System MUST return this attribute.

2436 “printer-state” (type1 enum) and
2437 “printer-state-reasons” (1setOf type2 keyword) and
2438 “printer-is-accepting-jobs” (boolean):

2439 The System MUST return all three of these attributes.

2440 Group N+1: System Attributes

2441 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2442 “system-uuid” (uri(45)):

2443 The System MUST return this attribute.

2444 “system-xri-supported” (1setOf collection)

2445 The System MUST return this attribute.

2446 “system-state” (type1 enum) and
2447 “system-state-reasons” (1setOf type2 keyword):

2448 The System MUST return both of these attributes.

2449 **6.3.12 Register-Output-Device**

2450 This CONDITIONALLY REQUIRED operation allows an authorized Proxy to register an
2451 Output Device with the target System object. Systems that conform to the IPP Shared
2452 Infrastructure Extensions [PWG5100.18] MUST support this operation.

2453 The Register-Output-Device operation returns a Printer object of the specified type that
2454 accepts Jobs on behalf of the Output Device. How these Printer objects are created or
2455 provisioned is implementation-specific.

2456 Access Rights: The authenticated user (see section 9.3 of [RFC8011]) performing this
2457 operation MUST be a Proxy of the System object. Otherwise, the System MUST reject the
2458 operation and return 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-
2459 not-authorized' as appropriate.

2460 **6.3.12.1 Register-Output-Device Request**

2461 The following groups of attributes are part of a Register-Output-Device request.

2462 Group 1: Operation Attributes

2463 “attributes-charset” (charset) and
2464 “attributes-natural-language” (naturalLanguage):

2465 The Client MUST supply and the System MUST support both of these
2466 attributes.

2467 “system-uri” (uri):

2468 The Client MUST supply and the System MUST support the “system-uri”
2469 operation attribute which is the target System for the operation.

2470 "output-device-uuid" (uri(45)):

2471 The Proxy MUST supply this attribute and the Infrastructure Printer MUST
2472 support this attribute. It provides the identity of the Output Device for the
2473 request.

2474 "requesting-user-name" (name(MAX)) and
2475 "requesting-user-uri" (uri) and
2476 "requesting-user-vcard" (1setOf text(MAX)):

2477 The Client SHOULD supply and the System MUST support all three of these
2478 attributes.

2479 “printer-service-type” (type2 keyword):

2480 The Client MUST supply and the System MUST support this attribute.

2481 "printer-xri-requested" (1setOf collection):

2482 The Client MAY supply and the System MUST support this attribute.

2483 **6.3.12.2 Register-Output-Device Response**

2484 The following groups of attributes are part of a Register-Output-Device response.

2485 Group 1: Operation Attributes

2486 "attributes-charset" (charset) and
2487 "attributes-natural-language" (naturalLanguage):

2488 The System MUST return both of these attributes.

2489 "status-message" (text(255)) and/or
2490 "detailed-status-message" (text(MAX)):

2491 The System MAY return one or both of these attributes.

2492 Group 2: Unsupported Attributes

2493 See [RFC8011] for details on returning Unsupported Attributes.

2494 Group 3: Printer Attributes

2495 See [RFC8011] for details on returning Printer Attributes.

2496 “printer-id” (integer(1:65535)):

2497 The System MUST return this attribute.

2498 “printer-uuid” (uri(45)):

2499 The System MUST return this attribute.

2500 “printer-xri-supported” (1setOf collection)

2501 The System MUST return this attribute.

2502 “printer-state” (type1 enum) and

2503 “printer-state-reasons” (1setOf type2 keyword) and

2504 “printer-is-accepting-jobs” (boolean):

2505 The System MUST return all three of these attributes.

2506 **6.3.13 Restart-System**

2507 This REQUIRED operation allows an authorized Operator or Administrator to restart an
2508 entire System with existing firmware or different firmware (from Install-Resource after
2509 Create-Resource and Send-Resource-Data). Figure 1 shows how this operation is
2510 processed.

2511 This operation can be used to restore the System to a known state when one or more
2512 configured Printers have become non-responsive or corrupted. This operation can also be
2513 used periodically to accomplish “software rejuvenation”, a proactive technique that was
2514 identified as a cost-effective solution during research at the AT&T Bell Laboratories on fault-
2515 tolerant software in the 1990s [REJUVENATION].

2516 This operation is semantically analogous to the Startup-Printer operation defined in
2517 [RFC3998].

2518 If accepted, the System MUST:

- 2519 1) Send a response to the Client (to confirm acceptance of the operation) that includes the
2520 “restart-get-interval (integer(0:MAX))” (section 7.1.19) operation attribute;
- 2521 4. Shutdown each configured Printer;
 - 2522 5. Install pending Resources;
 - 2523 6. Restart the entire System; and
 - 2524 7. Startup each configured Printer with the “printer-state” set to ‘stopped’ (unless
2525 there is another reason for the Printer to stay in the ‘idle’ or ‘processing’ state, in
2526 which case the ‘starting’ value is added to “printer-state-reasons”), “printer-is-

2527 accepting-jobs” set to ‘false’ (i.e., no incoming Jobs accepted), and the ‘paused’
2528 value added to “printer-state-reasons” (i.e., no Job processing output allowed).

2529 This operation will change the “system-state” of the System itself to ‘stopped’ when all
2530 Printers have completed shutdown and later started and moved to the ‘stopped’ state with
2531 the ‘starting’ value removed from “printer-state-reasons”.

2532 The Client can later send one or more Set-System-Attributes operations to modify the
2533 configuration of the System.

2534 Note 1: After a restart, all Printers must be enabled and resumed to continue processing
2535 Jobs. This is typically done using the Enable-All-Printers and Resume-All-Printers
2536 operations.

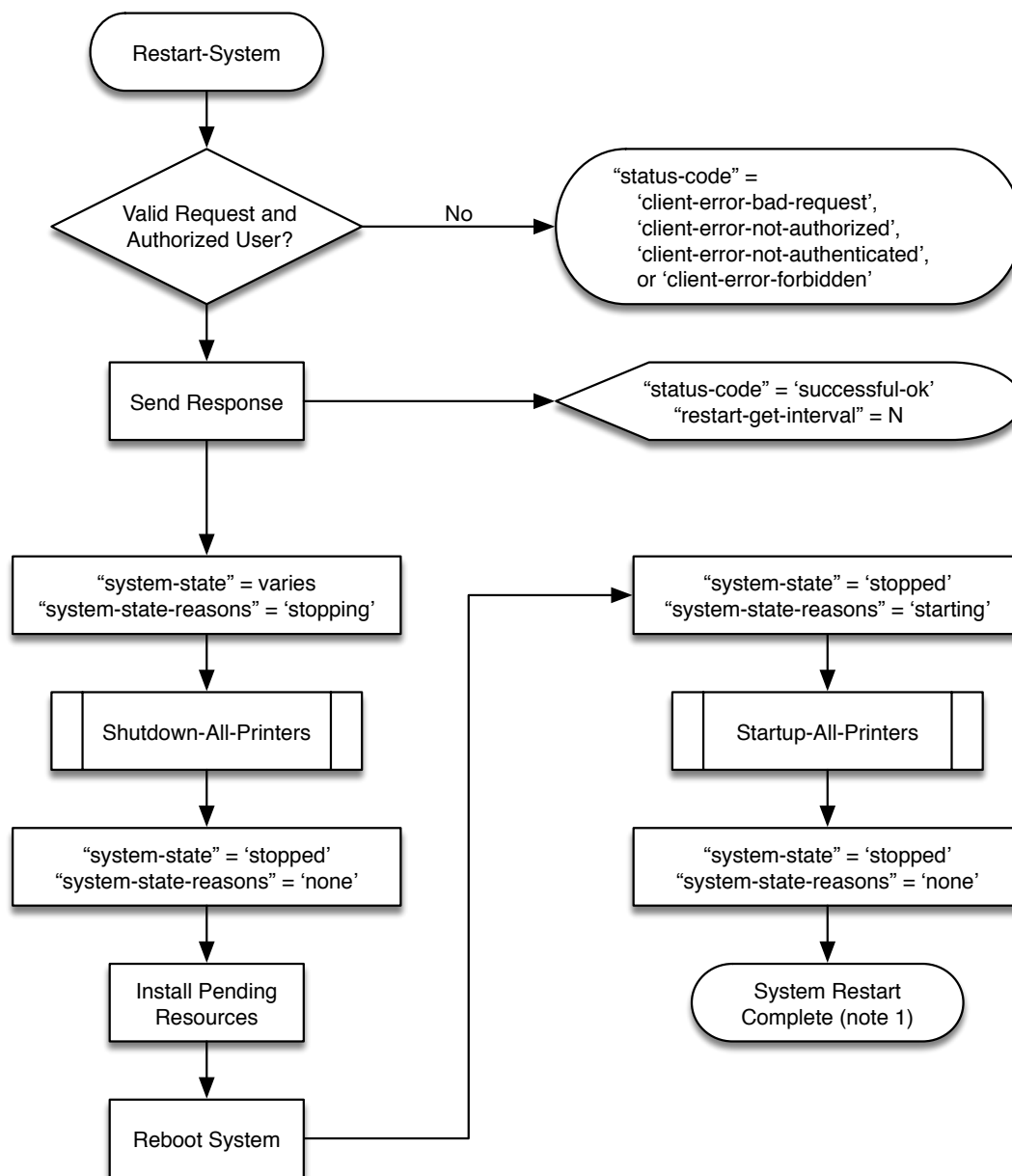


Figure 1 - Restart-System Flow Chart

2540 **6.3.13.1 Restart-System Request**

2541 The following groups of attributes are part of a Restart-System request.

2542 Group 1: Operation Attributes

2543 "attributes-charset" (charset) and
2544 "attributes-natural-language" (naturalLanguage):

2545 The Client MUST supply and the System MUST support both of these
2546 attributes.

2547 "system-uri" (uri):

2548 The Client MUST supply and the System MUST support the "system-uri"
2549 operation attribute which is the target System for the operation.

2550 "requesting-user-name" (name(MAX)) and
2551 "requesting-user-uri" (uri) and
2552 "requesting-user-vcard" (1setOf text(MAX)):

2553 The Client SHOULD supply and the System MUST support all three of these
2554 attributes.

2555 "system-message-from-operator" (text(127)):

2556 The Client MAY supply and the System MUST support this attribute.

2557 **6.3.13.2 Restart-System Response**

2558 The following groups of attributes are part of a Restart-System response.

2559 Group 1: Operation Attributes

2560 "attributes-charset" (charset) and
2561 "attributes-natural-language" (naturalLanguage):

2562 The System MUST return both of these attributes.

2563 "status-message" (text(255)) and/or
2564 "detailed-status-message" (text(MAX)):

2565 The System MAY return one or both of these attributes.

2566 "restart-get-interval" (integer(0:MAX)):

2567 If successful, the System MUST return this attribute which contains the
2568 number of seconds that the Client SHOULD wait before trying a Get-System-
2569 Attributes operation to confirm the completion of the System restart.

2570 Group 2: Unsupported Attributes

2571 See [RFC8011] for details on returning Unsupported Attributes.

2572 Group 3: System Attributes

2573 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2574 “system-uuid” (uri(45)):

2575 The System MUST return this attribute.

2576 “system-xri-supported” (1setOf collection)

2577 The System MUST return this attribute.

2578 “system-state” (type1 enum) and

2579 “system-state-reasons” (1setOf type2 keyword):

2580 The System MUST return both of these attributes.

2581 6.3.14 Resume-All-Printers

2582 This REQUIRED operation allows an authorized Operator or Administrator to resume all
2583 configured Printer objects (i.e., Job processing services) on the target System object. If no
2584 Printers are configured on the System, then the System MUST return a “status-code” of
2585 'successful-ok'.

2586 This operation is semantically equivalent to the ResumeAllServices operation defined in
2587 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Resume-
2588 Printer operations [RFC8011] to each configured Printer object.

2589 If accepted, the System MUST resume each configured Printer with the “printer-state” set to
2590 ‘idle’ and the ‘paused’ value removed from “printer-state-reasons” (unless there is another
2591 reason for the Printer to stay in the ‘stopped’ state, in which case the ‘resuming’ value is
2592 added to “printer-state-reasons”). This operation will change the “system-state” of the
2593 System itself to ‘idle’ when all configured Printers have completed resume and moved to the
2594 ‘idle’ state (with the ‘resuming’ value removed from “printer-state-reasons”).

2595 6.3.14.1 Resume-All-Printers Request

2596 The following groups of attributes are part of a Resume-All-Printers request.

2597 Group 1: Operation Attributes

- 2598 "attributes-charset" (charset) and
2599 "attributes-natural-language" (naturalLanguage):
- 2600 The Client MUST supply and the System MUST support both of these
2601 attributes.
- 2602 "system-uri" (uri):
- 2603 The Client MUST supply and the System MUST support the "system-uri"
2604 operation attribute which is the target System for the operation.
- 2605 "requesting-user-name" (name(MAX)) and
2606 "requesting-user-uri" (uri) and
2607 "requesting-user-vcard" (1setOf text(MAX)):
- 2608 The Client SHOULD supply and the System MUST support all three of these
2609 attributes.
- 2610 "system-message-from-operator" (text(127)):
- 2611 The Client MAY supply and the System MUST support this attribute.
- 2612 **6.3.14.2 Resume-All-Printers Response**
- 2613 The following groups of attributes are part of a Resume-All-Printers response.
- 2614 Group 1: Operation Attributes
- 2615 "attributes-charset" (charset) and
2616 "attributes-natural-language" (naturalLanguage):
- 2617 The System MUST return both of these attributes.
- 2618 "status-message" (text(255)) and/or
2619 "detailed-status-message" (text(MAX)):
- 2620 The System MAY return one or both of these attributes.
- 2621 Group 2: Unsupported Attributes
- 2622 See [RFC8011] for details on returning Unsupported Attributes.
- 2623 Groups 3-N: Printer Attributes
- 2624 See [RFC8011] for details on returning Printer Attributes.
- 2625 "printer-id" (integer(1:65535)):
- 2626 The System MUST return this attribute.

2627 “printer-uuid” (uri(45)):

2628 The System MUST return this attribute.

2629 “printer-xri-supported” (1setOf collection)

2630 The System MUST return this attribute.

2631 “printer-state” (type1 enum) and

2632 “printer-state-reasons” (1setOf type2 keyword) and

2633 “printer-is-accepting-jobs” (boolean):

2634 The System MUST return all three of these attributes.

2635 Group N+1: System Attributes

2636 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2637 “system-uuid” (uri(45)):

2638 The System MUST return this attribute.

2639 “system-xri-supported” (1setOf collection)

2640 The System MUST return this attribute.

2641 “system-state” (type1 enum) and

2642 “system-state-reasons” (1setOf type2 keyword):

2643 The System MUST return both of these attributes.

2644 6.3.15 Set-System-Attributes

2645 This REQUIRED operation allows an authorized Operator or Administrator to set the values
2646 of System Description attributes listed in “system-settable-attributes-supported” (see section
2647 7.2). For Client support for localization see “system-strings-languages-supported” and
2648 “system-strings-uri” in section 7.2. If one or more of the supplied System Description
2649 attributes and/or values are not actually settable, then the System MUST reject the entire
2650 request, indicating which attributes and/or values cannot be set, and return a “status-code”
2651 of 'client-error-not-possible'. See additional validation rules in section 4.1 Set-Printer-
2652 Attributes of [RFC3380].

2653 This operation is semantically equivalent to the SetSystemElements operation defined in
2654 [PWG5108.06] and semantically analogous to the Set-Printer-Attributes operation defined
2655 in [RFC3380].

2656 If accepted, the System MUST set every supplied System Description attribute to exactly
2657 the supplied value. The System MUST NOT partially set a subset of the supplied attributes.

2658 The System MUST accept this operation when the supplied attributes are valid and the value
2659 of “system-state” (see section 7.3) is either ‘idle’ or ‘stopped’. The System SHOULD accept
2660 this operation when the supplied attributes are valid and the value of “system-state” (see
2661 section 7.3) is ‘processing’. This operation does not change the “system-state” of the System
2662 itself.

2663 **6.3.15.1 Set-System-Attributes Request**

2664 The following groups of attributes are part of a Set-System-Attributes request.

2665 Group 1: Operation Attributes

2666 "attributes-charset" (charset) and
2667 "attributes-natural-language" (naturalLanguage):

2668 The Client MUST supply and the System MUST support both of these
2669 attributes.

2670 “system-uri” (uri):

2671 The Client MUST supply and the System MUST support the “system-uri”
2672 operation attribute which is the target System for the operation.

2673 "requesting-user-name" (name(MAX)) and
2674 "requesting-user-uri" (uri) and
2675 “requesting-user-vcard” (1setOf text(MAX)):

2676 The Client SHOULD supply and the System MUST support all three of these
2677 attributes.

2678 Group 2: System Attributes

2679 The IPP Client MUST supply a set of System attributes with one or more values
2680 (including explicitly allowed out-of-band values) as defined in [RFC8011] and
2681 section 7.2 of this document.

2682 See [RFC3380] for details on setting analogous Printer Attributes.

2683 **6.3.15.2 Set-System-Attributes Response**

2684 The following groups of attributes are part of a Set-System-Attributes response.

2685 Group 1: Operation Attributes

2686 "attributes-charset" (charset) and
2687 "attributes-natural-language" (naturalLanguage):

2688 The System MUST return both of these attributes.

2689 "status-message" (text(255)) and/or
2690 "detailed-status-message" (text(MAX)):

2691 The System MAY return one or both of these attributes.

2692 Group 2: Unsupported Attributes

2693 See [RFC8011] for details on returning Unsupported Attributes.

2694 Group 3: System Attributes

2695 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2696 "system-uuid" (uri(45)):

2697 The System MUST return this attribute.

2698 "system-xri-supported" (1setOf collection)

2699 The System MUST return this attribute.

2700 "system-state" (type1 enum) and
2701 "system-state-reasons" (1setOf type2 keyword):

2702 The System MUST return both of these attributes.

2703 6.3.16 Shutdown-All-Printers

2704 This REQUIRED operation allows an authorized Operator or Administrator to shutdown all
2705 configured Printer objects (i.e., Job processing services) on the target System object. If no
2706 Printers are configured on the System, then the System MUST return a "status-code" of
2707 'successful-ok'.

2708 This operation is semantically equivalent to the ShutdownAllServices operation defined in
2709 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Shutdown-
2710 Printer operations [RFC3998] to each configured Printer object (except for the resulting
2711 "printer-state" of 'stopped' rather than 'idle').

2712 If accepted, the System MUST shutdown each configured Printer that has not already been
2713 shut down with the "printer-state" set to 'stopped' (unless there is another reason for the
2714 Printer to stay in the 'idle' or 'processing' state, in which case the 'stopping' value is added
2715 to "printer-state-reasons") and the 'shutdown' value added to "printer-state-reasons". This
2716 operation will change the "system-state" of the System itself to 'stopped' when configured
2717 Printers have completed shutdown and moved to the 'stopped' state with the 'stopping' value
2718 removed from "printer-state-reasons".

2719 The Client can later send a Startup-All-Printers operation (preferred) or a sequence of
2720 Startup-One-Printer operations (preferred) or Startup-Printer operations [RFC3998] to each
2721 Printer to start up all of the configured Printers.

2722 **6.3.16.1 Shutdown-All-Printers Request**

2723 The following groups of attributes are part of a Shutdown-All-Printers request.

2724 Group 1: Operation Attributes

2725 "attributes-charset" (charset) and
2726 "attributes-natural-language" (naturalLanguage):

2727 The Client MUST supply and the System MUST support both of these
2728 attributes.

2729 "system-uri" (uri):

2730 The Client MUST supply and the System MUST support the "system-uri"
2731 operation attribute which is the target System for the operation.

2732 "requesting-user-name" (name(MAX)) and
2733 "requesting-user-uri" (uri) and
2734 "requesting-user-vcard" (1setOf text(1023)):

2735 The Client SHOULD supply and the System MUST support all three of these
2736 attributes.

2737 "system-message-from-operator" (text(127)):

2738 The Client MAY supply and the System MUST support this attribute.

2739 **6.3.16.2 Shutdown-All-Printers Response**

2740 The following groups of attributes are part of a Shutdown-All-Printers response.

2741 Group 1: Operation Attributes

2742 "attributes-charset" (charset) and
2743 "attributes-natural-language" (naturalLanguage):

2744 The System MUST return both of these attributes.

2745 "status-message" (text(255)) and/or
2746 "detailed-status-message" (text(MAX)):

2747 The System MAY return one or both of these attributes.

2748 Group 2: Unsupported Attributes

2749 See [RFC8011] for details on returning Unsupported Attributes.

2750 Groups 3-N: Printer Attributes

2751 See [RFC8011] for details on returning Printer Attributes.

2752 “printer-id” (integer(1:65535)):

2753 The System MUST return this attribute.

2754 “printer-uuid” (uri(45)):

2755 The System MUST return this attribute.

2756 “printer-xri-supported” (1setOf collection)

2757 The System MUST return this attribute.

2758 “printer-state” (type1 enum) and

2759 “printer-state-reasons” (1setOf type2 keyword) and

2760 “printer-is-accepting-jobs” (boolean):

2761 The System MUST return all three of these attributes.

2762 Group N+1: System Attributes

2763 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2764 “system-uuid” (uri(45)):

2765 The System MUST return this attribute.

2766 “system-xri-supported” (1setOf collection)

2767 The System MUST return this attribute.

2768 “system-state” (type1 enum) and

2769 “system-state-reasons” (1setOf type2 keyword):

2770 The System MUST return both of these attributes.

2771 **6.3.17 Startup-All-Printers**

2772 This REQUIRED operation allows an authorized Operator or Administrator to startup or
2773 restart all configured Printer objects (i.e., Job processing services) on the target System
2774 object. If no Printers are configured on the System, then the System MUST return a “status-
2775 code” of 'successful-ok'.

2776 This operation is semantically equivalent to the StartupAllServices operation defined in
2777 [PWG5108.06]. This operation is also semantically equivalent to a sequence of Startup-One-
2778 Printer operations for each configured Printer object.

2779 If accepted, the System MUST startup or restart each configured Printer with the “printer-
2780 state” set to ‘stopped’ (unless there is another reason for the Printer to stay in the ‘idle’ or
2781 ‘processing’ state, in which case the ‘starting’ value is added to “printer-state-reasons”),
2782 “printer-is-accepting-jobs” set to ‘false’ (i.e., no incoming Jobs accepted), and the ‘paused’
2783 value added to “printer-state-reasons” (i.e., no Job processing output allowed). This
2784 operation will change the “system-state” of the System itself to ‘stopped’ when all Printers
2785 have completed startup and moved to the ‘stopped’ state with the ‘starting’ value removed
2786 from “printer-state-reasons”.

2787 The Client can later send one or more Set-Printer-Attributes operations to modify the
2788 configuration of each Printer, followed by Resume-Printer (i.e., remove ‘paused’ from
2789 “printer-state-reasons”) and Enable-Printer (i.e., change “printer-is-accepting-jobs” to ‘true’).

2790 **6.3.17.1 Startup-All-Printers Request**

2791 The following groups of attributes are part of a Startup-All-Printers request.

2792 Group 1: Operation Attributes

2793 "attributes-charset" (charset) and
2794 "attributes-natural-language" (naturalLanguage):

2795 The Client MUST supply and the System MUST support both of these
2796 attributes.

2797 “system-uri” (uri):

2798 The Client MUST supply and the System MUST support the “system-uri”
2799 operation attribute which is the target System for the operation.

2800 "requesting-user-name" (name(MAX)) and
2801 "requesting-user-uri" (uri) and
2802 “requesting-user-vcard” (1setOf text(MAX)):

2803 The Client SHOULD supply and the System MUST support all three of these
2804 attributes.

2805 “system-message-from-operator” (text(127)):

2806 The Client MAY supply and the System MUST support this attribute.

2807 **6.3.17.2 Startup-All-Printers Response**

2808 The following groups of attributes are part of a Startup-All-Printers response.

2809 Group 1: Operation Attributes

2810 "attributes-charset" (charset) and
2811 "attributes-natural-language" (naturalLanguage):

2812 The System MUST return both of these attributes.

2813 "status-message" (text(255)) and/or
2814 "detailed-status-message" (text(MAX)):

2815 The System MAY return one or both of these attributes.

2816 Group 2: Unsupported Attributes

2817 See [RFC8011] for details on returning Unsupported Attributes.

2818 Groups 3-N: Printer Attributes

2819 See [RFC8011] for details on returning Printer Attributes.

2820 "printer-id" (integer(1:65535)):

2821 The System MUST return this attribute.

2822 "printer-uuid" (uri(45)):

2823 The System MUST return this attribute.

2824 "printer-xri-supported" (1setOf collection)

2825 The System MUST return this attribute.

2826 "printer-state" (type1 enum) and
2827 "printer-state-reasons" (1setOf type2 keyword) and
2828 "printer-is-accepting-jobs" (boolean):

2829 The System MUST return all three of these attributes.

2830 Group N+1: System Attributes

2831 See [RFC8011] and [RFC3380] for details on returning analogous Printer Attributes.

2832 "system-uuid" (uri(45)):

2833 The System MUST return this attribute.

2834 "system-xri-supported" (1setOf collection)

2835 The System MUST return this attribute.

2836 “system-state” (type1 enum) and
2837 “system-state-reasons” (1setOf type2 keyword):

2838 The System MUST return both of these attributes.

2839 **7. IPP Attributes**

2840 **7.1 Operation Attributes**

2841 The following operation attributes can be applicable to one or more System, Printer,
2842 Resource, Job, or Subscription operations.

2843 **7.1.1 job-resource-ids (1setOf integer(1:MAX))**

2844 This operation attribute specifies a list of Printer resource IDs that are to be allocated to a
2845 created Job. The successfully allocated resource IDs are copied to the corresponding "job-
2846 resource-ids" Job Status attribute (section 7.4.2).

2847 **7.1.2 printer-id (integer(1:65535))**

2848 This operation attribute specifies the target Printer object as used in Get-Printer-Attributes
2849 and some other Printer operations defined in section 6 and is semantically equivalent to the
2850 ServiceSummary element ID defined in [PWG5108.06] and semantically analogous to the
2851 “job-id” attribute defined in [RFC8011]. See “printer-id” in section 7.5 Printer Status
2852 Attributes.

2853 **7.1.3 printer-ids (1setOf (integer(1:65535)))**

2854 This operation attribute specifies the list of “printer-id” values for target Printer objects as
2855 used in Get-Printers and some other Printer operations defined in section 6 and is
2856 semantically equivalent a list of the ServiceSummary element ID defined in [PWG5108.06]
2857 and semantically analogous a list of the “job-id” attribute defined in [RFC8011]. See “printer-
2858 id” in section 7.5 Printer Status Attributes.

2859 **7.1.4 printer-geo-location (uri)**

2860 This operation attribute specifies a filter for the applicable Printers as used in Get-Printers
2861 defined in section 6 and is semantically analogous to the “printer-geo-location” attribute
2862 defined in [PWG5100.13].

2863 **7.1.5 printer-location (text(127))**

2864 This operation attribute specifies a filter for the applicable Printers as used in Get-Printers
2865 defined in section 6 and is semantically analogous to the “printer-location” attribute defined
2866 in [RFC8011].

2867 7.1.6 printer-service-type (1setOf (type2 keyword))

2868 This operation attribute specifies the service type for a Printer as used in Create-Printer or
2869 a filter for the applicable Printers as used in Get-Printers defined in section 6 and is
2870 semantically equivalent to the ServiceSummary element ServiceType defined in
2871 [PWG5108.06]. See “printer-service-type” in section 7.5 Printer Status Attributes.

2872 7.1.7 printer-xri-requested (1setOf type2 collection)

2873 This operation attribute specifies the type of authentication ("xri-authentication (type2
2874 keyword)" member attribute) and security ("xri-security (type2 keyword)" member attribute)
2875 that is wanted for newly created Printers using the Create-Printer operation (section 6.3.1).
2876 The "xri-uri (uri)" member attribute MUST NOT be included in the collection since the System
2877 assigns that value.

2878 7.1.8 requesting-user-vcard (1setOf text(MAX))

2879 This operation attribute contains the System, Printer, Resource, or Job Owner vCard
2880 [RFC6350] for a Set-System-Attributes, Create-Printer, Create-Resource, or Job Creation
2881 operation and is semantically analogous to the Service object's OwnerVCard defined in
2882 [PWG5108.01]. See “printer-owner-col” (section 7.4) and “resource-owner-col” (section 7.6)
2883 description attributes for updates via subsequent Set-Printer-Attributes or Set-Resource-
2884 Attributes operations.

2885 The recorded values System, Printer, Resource, or Job Owner MUST identify the most
2886 authenticated user information. As with “requesting-user-name” [RFC8011], the most
2887 authenticated user information is copied to the System, Printer, Resource, or Job object.

2888 7.1.9 resource-format (mimeMediaType)

2889 This operation attribute specifies the format for a Resource as used in Send-Resource-Data
2890 request or a filter for the applicable Resources as used in Get-Resources defined in section
2891 6 and is semantically equivalent to the ResourceFormat element defined in [PWG5108.03]
2892 and semantically analogous to the “document-format” attribute defined in [RFC8011]. See
2893 “resource-format” in section 7.7 Resource Status Attributes.

2894 7.1.10 resource-format-accepted (1setOf mimeMediaType)

2895 This operation attribute specifies the accepted formats for a Resource as used in Create-
2896 Resource response and is semantically analogous to the ResourceFormat element defined
2897 in [PWG5108.03] and semantically analogous to the “document-format” attribute defined in
2898 [RFC8011]. See “resource-format” in section 7.7 Resource Status Attributes.

2899 7.1.11 resource-formats (1setOf (mimeMediaType))

2900 This operation attribute specifies a filter for the applicable Resources as used in Get-
2901 Resources defined in section 6 and is semantically analogous to the ResourceFormat
2902 element defined in [PWG5108.03] and semantically analogous to the “document-format”

2903 attribute defined in [RFC8011]. See “resource-format” in section 7.7 Resource Status
2904 Attributes.

2905 **7.1.12 resource-id (integer(1:MAX))**

2906 This operation attribute specifies the target Resource object as used in Get-Resource-
2907 Attributes and other Resource operations defined in section 6 and is semantically equivalent
2908 to the ResourceId element defined in [PWG5108.03] and semantically analogous to the “job-
2909 id” attribute defined in [RFC8011]. See “resource-id” in section 7.7 Resource Status
2910 Attributes.

2911 **7.1.13 resource-ids (1setOf integer(1:MAX))**

2912 This operation attribute specifies the list of “resource-id” values for associated Resource
2913 objects as used in the Create-Printer and Allocate-Printer-Resources operations defined in
2914 section 6 or in a Job Creation operation (Create-Job, Print-Job, or Print-URI) defined in
2915 [RFC8011] and is semantically analogous to the “job-printer-uri” attribute defined in
2916 [RFC8011]. See “resource-id” in section 7.7 Resource Status Attributes.

2917 **7.1.14 resource-k-octets (integer(0:MAX))**

2918 This operation attribute specifies the size of the data for a Resource as used in Create-
2919 Resource/Send-Resource-Data defined in section 6 and is semantically analogous to the
2920 “job-k-octets” attribute defined in [RFC8011]. See “resource-k-octets” in section 7.7
2921 Resource Status Attributes.

2922 **7.1.15 resource-signature (1setOf octetString)**

2923 This operation attribute specifies an out-of-band digital signature for Resource data as used
2924 in Send-Resource-Data defined in section 6.2.5, when the particular Resource data format
2925 does not include an embedded digital signature.

2926 A Client MAY also supply this operation attribute with an out-of-band digital signature to
2927 request override of an embedded digital signature in the Resource data (e.g., when the
2928 embedded signature has been invalidated due to compromised keys, compromised
2929 algorithms, compromised CAs, etc.). An IPP System SHOULD support this method of
2930 signature override for long-term stability.

2931 See section 12 Security Considerations for details of digital signature handling in IPP System
2932 Service.

2933 **7.1.16 resource-states (1setOf (type1 enum))**

2934 This operation attribute specifies a filter for the applicable Resources as used in Get-
2935 Resources defined in section 6 and is semantically analogous to the “job-state” attribute
2936 defined in [RFC8011] and replaces the semantically analogous DateTimeAtExpiration
2937 (Resource lease time) and ResourceIsExpired elements defined in [PWG5108.03]. See
2938 “resource-state” in section 7.7 Resource Status Attributes.

2939 7.1.17 resource-type (type2 keyword)

2940 This operation attribute specifies a type for the new Resource as used in Create-Resource
2941 defined in section 6 and replaces the semantically analogous DateTimeAtExpiration
2942 (Resource lease time) element defined in [PWG5108.03]. See “resource-type” in section 7.7
2943 Resource Status Attributes.

2944 7.1.18 resource-types (1setOf (type2 keyword))

2945 This operation attribute specifies a filter for the applicable Resources as used in Get-
2946 Resources defined in section 6 and replaces the semantically analogous
2947 DateTimeAtExpiration (Resource lease time) element defined in [PWG5108.03]. See
2948 “resource-type” in section 7.7 Resource Status Attributes.

2949 7.1.19 restart-get-interval (integer(0:MAX))

2950 This operation attribute specifies an interval in seconds that the Client SHOULD wait before
2951 querying the System with a Get-System-Attributes operation to confirm completion of the
2952 restart requested by a Restart-System operation and is semantically analogous to the
2953 “notify-get-interval” attribute defined in [RFC3996].

2954 7.1.20 system-uri (uri)

2955 This operation attribute specifies the target System object as used in Get-Printers and all
2956 other operations defined in section 6 and is semantically analogous to the “printer-uri”
2957 attribute defined in [RFC8011] and semantically equivalent to the “SystemURI” attribute
2958 defined in [PWG5108.06].

2959 7.1.21 which-printers (type2 keyword):

2960 This operation attribute specifies a filter for the applicable Printers as used in Get-Printers
2961 defined in section 6 and is semantically analogous to the “which-jobs” attribute defined in
2962 [RFC8011].

2963 Standard keyword values for this attribute include:

2964 ‘accepting’: All Printers with “printer-state” of ‘idle’ or ‘processing’ and “printer-is-
2965 accepting-jobs” of ‘true’.

2966 ‘all’: All Printers configured on this System object, regardless of their state.

2967 ‘idle’: All Printers with “printer-state” of ‘idle’.

2968 ‘not-accepting’: All Printers with “printer-is-accepting-jobs” of ‘false’.

2969 ‘processing’: All Printers with “printer-state” of ‘processing’.

2970 'shutdown': All Printers with "printer-state" of 'stopped' and "printer-state-reasons"
2971 of 'shutdown'.

2972 'stopped': All Printers with "printer-state" of 'stopped', but do not have "printer-state-
2973 reasons" of 'shutdown' or 'testing'.

2974 'testing': All Printers with "printer-state" of 'stopped' and "printer-state-reasons" of
2975 testing'.

2976 **7.2 System Description Attributes**

2977 System Description attributes are typically READ-WRITE and can potentially be set by an
2978 Operator or Administrator using the Set-System-Attributes operation (see section 6).
2979 Writable System Description attributes are listed in the value of "system-settable-attributes-
2980 supported" (see section 7.2).

2981 **7.2.1 Power States and Policies**

2982 This specification imports (and renames for clarity and common usage) the normative
2983 definitions and semantics of System power states from the PWG Power Management Model
2984 for Imaging Systems 1.0 [PWG5106.4], which is aligned with DMTF CIM and ACPI power
2985 state definitions and semantics.

2986 **7.2.1.1 IEEE 1621 Power Modes**

2987 [IEEE1621] (which is primarily concerned with a simple user interface) defines 3 basic power
2988 modes: Off Mode, Sleep Mode, and On Mode. These power modes in turn can be qualified
2989 with "soft / hard", "light / deep", and "graceful" to describe specific power states (see the
2990 following sections on DMTF stable and ephemeral power states).

2991 Off Mode – the set of power states where incoming jobs cannot be accepted
2992 immediately and existing jobs cannot be processed immediately (i.e., without a long
2993 delay for a power state transition to On Mode).

2994 On Mode – the set of power states where incoming jobs can be accepted
2995 immediately and existing jobs can be processed immediately (i.e., with no delay for
2996 a power state transition).

2997 Sleep Mode – the set of power states where incoming jobs MAY be accepted
2998 immediately, but existing jobs cannot be processed immediately (i.e., without a
2999 short delay for a power state transition to On Mode).

3000 **7.2.1.2 DMTF Stable Power States**

3001 This specification imports (and renames for clarity and common usage) the normative
3002 definitions and semantics of the following DMTF CIM [DSP1027] stable power states. All

- 3003 other DMTF CIM power states are ephemeral (orderly shutdowns and power resets) and will
3004 eventually result in one of the stable power states defined below.
- 3005 'hibernate': DMTF "Hibernate (Off-Soft)" (7) and ACPI S4. The stable "Off Mode"
3006 power state where all kernel and application programs and data have been saved
3007 (e.g., to a hard disk) such that a transition to On allows recovery and continued
3008 processing without any loss of jobs or data. Limited auxiliary power is consumed
3009 (e.g., console lights), no network interfaces are operational, and human intervention
3010 is required to power up the system.
- 3011 'off-hard': DMTF "Off-Hard" (6) and ACPI G3. The stable "Off Mode" power state
3012 where System power is mechanically or electrically turned off. No power is
3013 consumed, no network interfaces are operational, and human intervention is
3014 required to power up the System.
- 3015 'off-soft': DMTF "Off-Soft" (8) and ACPI G2 or S5. The stable "Off Mode" power
3016 state where only limited auxiliary power is consumed (e.g., console lights), no
3017 network interfaces are operational, and human intervention is required to power up
3018 the system.
- 3019 'on': DMTF "On" (2) – ACPI G0 or S0 – the stable "On Mode" power state where
3020 the System is in 'idle', 'processing', or 'stopped' operational states, with no delay
3021 required for a power state transition before processing incoming jobs.
- 3022 'standby': DMTF "Sleep-Light" (3) and ACPI S1 or S2. The stable "Sleep Mode"
3023 power state with the shortest wake-up transition to the 'on' power state. Typically,
3024 mechanical elements (motors, lamps, heaters, etc.) are turned off or turned down,
3025 but processors and network interfaces are fully active (e.g., normal clock rate).
- 3026 'suspend': DMTF "Sleep-Deep" (4) and ACPI S3. The stable "Sleep Mode" power
3027 state with the lowest power consumption of any "Sleep Mode" power state.
3028 Typically, mechanical elements (motors, lamps, heaters, etc.) are turned off, but
3029 processors and network interfaces are partially active (e.g., lower clock rate). Kernel
3030 and application programs and data are preserved (i.e., periodically refreshed) in
3031 main memory and at least one network interface is operational.
- 3032 Additional vendor-specific power sub-states are defined as qualifiers of the stable power
3033 states 'hibernate', 'off-soft', 'on', 'standby', and 'suspend' (but not 'off-hard'). These
3034 additional power sub-state keywords are all of the form '<base>-vendorN' where 'N' is from
3035 '1' to '5' and the semantics MUST be exactly the same as those defined for these power
3036 sub-states as defined in [PWG5106.4]. Vendor-specific power sub-states MUST be used in
3037 strict order according to their nominal power consumption, e.g., 'standby-vendor2' MUST
3038 consume power equal to or higher than 'standby-vendor1' and 'standby-vendor1' MUST
3039 consume power equal to or higher than 'standby' (the base state).

7.2.1.3 DMTF Ephemeral Power States

This specification imports (and renames for clarity and common usage) the normative definitions and semantics of the following DMTF CIM [DSP1027] ephemeral (transitional) power states that initiate orderly shutdowns (e.g., ‘off-soft-graceful’) and power resets (e.g., ‘reset-hard’). All DMTF CIM ephemeral power state transitions will eventually result in one of the stable power states defined in section 7.2.1.2 above.

‘off-hard-graceful’: DMTF “Off-Hard Graceful” (13) and ACPI G3. The ephemeral power state that performs a graceful hard power off (orderly shutdown, followed by a hard power off cycle) and completes in the ‘off-hard’ power state.

‘off-soft-graceful’: DMTF “Off-Soft Graceful” (12) and ACPI G2 or S5. The ephemeral power state that performs a graceful soft power off (orderly shutdown, followed by a soft power off cycle) and completes in the ‘off-soft’ power state.

‘reset-hard’: DMTF “Power Cycle (Off-Hard)” (9) and ACPI G0 to G3, then S0. The ephemeral power state that performs a hard power reset (hard power off cycle, followed by normal power on cycle) and completes in the ‘on’ power state.

‘reset-hard-graceful’: DMTF “Power Cycle Off-Soft Graceful” (16) and ACPI G3, then S0. The ephemeral power state that performs a graceful hard power reset (orderly shutdown, followed by a hard power reset) and completes in the ‘on’ power state.

‘reset-init’: DMTF “Diagnostic Interrupt (INIT)” (17) and ACPI S5, then S0. The ephemeral power state (based on a diagnostic interrupt) that performs a hard power reset (hard power off cycle, followed by normal power on cycle) and completes in the ‘on’ power state.

‘reset-mbr’: DMTF “Master Bus Reset” (10) and ACPI S5, then S0. The ephemeral power state (based on a master bus reset) that performs a hard power reset (hard power off cycle, followed by normal power on cycle) and completes in the ‘on’ power state.

‘reset-mbr-graceful’: DMTF “Master Bus Reset Graceful” (14) and ACPI S5, then S0. The ephemeral power state that performs an orderly shutdown, followed by an MBR reset, and completes in the ‘on’ power state.

‘reset-nmi’: DMTF “Diagnostic Interrupt (NMI)” (11) and ACPI S5, then S0. The ephemeral power state (based on a non-maskable interrupt) that performs a hard power reset (hard power off cycle, followed by normal power on cycle) and completes in the ‘on’ power state.

‘reset-soft’: DMTF “Power Cycle (Off-Soft)” (5) and ACPI G2 or S5, then S0 w/ lost context. The ephemeral power state that performs a soft power reset (soft power off, followed by normal power on cycle) and completes in the ‘on’ power state.

3077 'reset-soft-graceful': DMTF "Power Cycle Off-Soft Graceful" (16) and ACPI G2 or
 3078 S5, then S0 w/ lost context. The ephemeral power state that performs a graceful
 3079 soft power reset (orderly shutdown, followed by a soft power reset) and completes
 3080 in the 'on' power state.

3081 7.2.1.4 Power Policies

3082 Power state transition policies can be scheduled by an Operator or Administrator in "power-
 3083 calendar-policy-col", "power-event-policy-col", and "power-timeout-policy-col" System
 3084 attributes. These policies can use triggers based on calendar times (e.g., 1st day of month),
 3085 named events (e.g., 'jam'), or elapsed time (e.g., 5 minutes of inactivity after entering
 3086 'standby' power state resulting in a further transition to 'suspend' power state).

3087 System administrative operations can also invoke System power state transitions (e.g.,
 3088 Restart-System can invoke a 'reset-soft-graceful' transition). Job creation operations can be
 3089 delayed in some System power states (e.g., during the warm up transition from 'suspend' to
 3090 'on'). Job creation operations can also be prohibited in some System power states (e.g., in
 3091 'hibernate' and 'off-soft').

3092 Note: This specification intentionally does not define any explicit operations for changing
 3093 System power states. System power policies can be used instead to schedule power state
 3094 transitions.

3095 An example of an automated System power state transition to 'hibernate' at 6pm every
 3096 Friday evening could be scheduled in "power-calendar-policy-col" as follows:

```
3097     calendar-id=32      # arbitrary unique value for calendar policy
3098     day-of-week=6       # Friday is 6th day counting from Sunday
3099     hour=18             # 6pm is 18:00 on a 24-hour clock
3100     request-power-state='hibernate'
3101                       # target power state
```

3102 In the above example, the irrelevant "day-of-month", "minute", "month", and "run-once"
 3103 member attributes have been omitted.

3104 An example of a Restart-System operation implementation could be as follows:

- 3105 1. 'stopping' is added to "system-state-reasons" for the System.
- 3106 2. 'stopping' is added to "printer-state-reasons" for each configured Printer.
- 3107 3. 'processing-to-stop-point' is added to "job-state-reasons" for each active Job.
- 3108 4. All active Jobs complete normally (because the stop point is a Job boundary)
 3109 and 'processing-to-stop-point' is removed from "job-state-reasons" for each
 3110 completed Job.
- 3111 5. 'stopping' is removed from "printer-state-reasons" and "printer-state" is changed
 3112 to 'stopped' for each configured Printer.
- 3113 6. 'stopping' is removed from "system-state-reasons" and "system-state" is
 3114 changed to 'stopped' for the System.

- 3115 7. The System executes a 'reset-soft-graceful' transition, resulting in "power-state"
3116 in "power-state-monitor-col" values: on → standby → off-soft → standby → on.
3117 8. "system-state" is changed to 'idle' for the System and "printer-state" is changed
3118 to 'idle' for each configured Printer.
3119 9. Job processing resumes normally on all Printers.

3120 **7.2.2 charset-configured (charset)**

3121 This REQUIRED System attribute identifies the charset that is used to represent attributes
3122 with 'text' and 'name' attribute syntaxes and is semantically analogous to the "charset-
3123 configured" Printer attribute defined in [RFC8011]. The value of the "charset-configured"
3124 attribute MUST be one of the values of the "charset-supported" attribute defined in section
3125 7.2.2.

3126 **7.2.3 charset-supported (1setOf charset)**

3127 This REQUIRED System attribute lists the charsets that are supported for values of
3128 attributes with 'text' and 'name' attribute syntaxes and is semantically analogous to the
3129 "charset-supported" Printer attribute defined in [RFC8011]. The value 'utf-8' MUST be
3130 present, since IPP objects MUST support the UTF-8 [RFC3629] charset.

3131 **7.2.4 document-format-supported (1setOf mimeType)**

3132 This REQUIRED System attribute lists the Document formats that are supported by Printers
3133 managed by the System.

3134 **7.2.5 ippget-event-life (integer(15:MAX))**

3135 This REQUIRED System attribute specifies the Event Life value that the System assigns to
3136 each Event and is semantically equivalent to the "ippget-event-life" Printer attribute defined
3137 in [RFC3996].

3138 **7.2.6 ipp-features-supported (1setOf type2 keyword)**

3139 This REQUIRED System attribute lists the IPP extension features that are supported by the
3140 System and is semantically analogous to the "ipp-features-supported" Printer attribute
3141 defined in [PWG5100.13]. Standard keyword values are listed in the IANA IPP Registry. The
3142 value 'none' MUST be reported if no extension features are supported and MUST NOT be
3143 reported otherwise.

3144 **7.2.7 ipp-versions-supported (1setOf type2 keyword)**

3145 This REQUIRED System attribute identifies the supported IPP protocol version(s) and is
3146 semantically analogous to the "ipp-versions-supported" Printer attribute defined in
3147 [RFC8011].

3148 7.2.8 multiple-document-printers-supported (boolean)

3149 This REQUIRED System attribute specifies whether Printers managed by the System are
3150 capable of supporting multiple Document Jobs and is semantically analogous to the
3151 "multiple-document-jobs-supported" Printer Description attribute [RFC8011].

3152 7.2.9 natural-language-configured (naturalLanguage)

3153 This REQUIRED System attribute identifies the natural language that is used for System-
3154 generated attribute values with 'text' and 'name' attribute syntaxes and is semantically
3155 analogous to the "natural-language-configured" Printer attribute defined in [RFC8011].

3156 7.2.10 generated-natural-language-supported (1setOf naturalLanguage)

3157 This REQUIRED System attribute lists the natural language(s) that are supported for
3158 System-generated attribute values with 'text' and 'name' attribute syntaxes and is
3159 semantically analogous to the "generated-natural-language-supported" Printer attribute
3160 defined in [RFC8011].

3161 Note: The natural language(s) supported for System-generated values depends on
3162 implementation and/or configuration. However, unlike charsets, System objects MUST
3163 accept requests with any natural language or any Natural Language Override whether or not
3164 the natural language is supported for System-generated attribute values.

3165 Note: A System that supports multiple natural languages, often has separate catalogs of
3166 messages, one for each natural language supported.

3167 7.2.11 notify-attributes-supported (1setOf keyword)

3168 This REQUIRED System attribute lists additional attributes that can be included in an event
3169 notification and is semantically equivalent to the Printer attribute of the same name defined
3170 in [RFC3995].

3171 7.2.12 notify-events-default (1setOf type2 keyword)

3172 This REQUIRED System attribute lists the default events for new Subscriptions and is
3173 semantically equivalent to the Printer attribute of the same name defined in [RFC3995].

3174 7.2.13 notify-events-supported (1setOf type2 keyword)

3175 This REQUIRED System attribute lists the supported "notify-events" values and is
3176 semantically equivalent to the Printer attribute of the same name defined in [RFC3995].

3177 7.2.14 notify-lease-duration-default (integer(0:67108863))

3178 This REQUIRED System attribute specifies the default lease duration for a new Subscription
3179 object and is semantically equivalent to the Printer attribute of the same name defined in
3180 [RFC3995].

3181 **7.2.15 notify-lease-duration-supported (1setOf (integer(0:67108863) |**
 3182 **rangeOfInteger(0: 67108863)))**

3183 This REQUIRED System attribute lists the supported lease duration values and is
 3184 semantically equivalent to the Printer attribute of the same name defined in [RFC3995].

3185 **7.2.16 notify-max-events-supported (integer(2:MAX))**

3186 This REQUIRED System attribute specifies the maximum number of events that can be
 3187 specified in the "notify-events" Subscription Template attribute and is semantically
 3188 equivalent to the Printer attribute of the same name defined in [RFC3995].

3189 **7.2.17 notify-pull-method-supported (1setOf type2 keyword)**

3190 This REQUIRED System attribute lists the supported pull notification methods and is
 3191 semantically equivalent to the Printer attribute of the same name defined in [RFC3995].
 3192 Systems MUST support the 'ippget' pull notification method.

3193 **7.2.18 notify-schemes-supported (1setOf uriScheme)**

3194 This CONDITIONALLY REQUIRED System attribute lists push notification schemes that are
 3195 supported by the System and is semantically equivalent to the Printer attribute of the same
 3196 name defined in [RFC3995]. This attribute MUST be supported if the System supports push
 3197 notifications.

3198 **7.2.19 operations-supported (1setOf type2 enum)**

3199 This REQUIRED System attribute lists the supported System operations and is semantically
 3200 analogous to the "operations-supported" Printer attribute defined in [RFC8011].

3201 **7.2.20 power-calendar-policy-col (1setOf collection)**

3202 This OPTIONAL System attribute lists the configured System calendar-based power state
 3203 change policies and is semantically equivalent to the Power Calendar group defined in
 3204 [PWG5106.4]. If "power-calendar-policy-col" is supported, then all member attributes in this
 3205 collection are REQUIRED for the System but are OPTIONAL for the Client to supply.

3206 For example, an automated System power state transition to 'hibernate' at 6pm every Friday
 3207 evening could be scheduled in "power-calendar-policy-col" as follows:

```
3208     calendar-id=32      # arbitrary unique value for calendar policy
3209     day-of-week=6      # Friday is 6th day counting from Sunday
3210     hour=18            # 6pm is 18:00 on a 24-hour clock
3211     request-power-state='hibernate'
3212                       # target power state
```

3213 In the above example, the irrelevant "day-of-month", "minute", "month", and "run-once"
 3214 member attributes have been omitted.

3215 7.2.20.1 calendar-id (integer(1:MAX))

3216 This REQUIRED member attribute contains the unique key of this calendar policy and is
3217 semantically equivalent to the CalendarID element in the Power Calendar group defined in
3218 [PWG5106.4].

3219 7.2.20.2 day-of-month (integer(1:31))

3220 This REQUIRED member attribute specifies the trigger day of the month for this calendar
3221 policy and is semantically equivalent to the CalendarDay element in the Power Calendar
3222 group defined in [PWG5106.4]. The value '1' represents the first day of the month.

3223 See "system-current-time" defined above for the relevant System date, time, and time zone
3224 values.

3225 7.2.20.3 day-of-week (integer(1:7))

3226 This REQUIRED member attribute specifies the trigger day of the week for this calendar
3227 policy and is semantically equivalent to the CalendarDayOfWeek element in the Power
3228 Calendar group defined in [PWG5106.4]. The value '1' represents Sunday.

3229 See "system-current-time" defined above for the relevant System date, time, and time zone
3230 values.

3231 7.2.20.4 hour (integer(0:23))

3232 This REQUIRED member attribute specifies the trigger hour for this calendar policy and is
3233 semantically equivalent to the CalendarHour element in the Power Calendar group defined
3234 in [PWG5106.4]. The value '0' represents the first hour of the day (i.e., 12:00-12:59am).
3235 Midnight (i.e., 12:00am) is specified by a value of zero for "hour" and a value of zero for
3236 "minute".

3237 See "system-current-time" defined above for the relevant System date, time, and time zone
3238 values.

3239 Note: Due to local time zone changes (summer time to standard time or vice versa), it's
3240 possible that a given hour will not occur in a given month.

3241 7.2.20.5 minute (integer(0:59))

3242 This REQUIRED member attribute specifies the trigger minute for this calendar policy and
3243 is semantically equivalent to the CalendarMinute element in the Power Calendar group
3244 defined in [PWG5106.4]. The value '0' represents the first minute of the hour (e.g., 7:00am).

3245 See "system-current-time" defined above for the relevant System date, time, and time zone
3246 values.

3247 7.2.20.6 month (integer(1:12))

3248 This REQUIRED member attribute specifies the trigger month for this calendar policy and is
 3249 semantically equivalent to the CalendarMonth element in the Power Calendar group defined
 3250 in [PWG5106.4]. The value of '1' represents January.

3251 See "system-current-time" defined above for the relevant System date, time, and time zone
 3252 values.

3253 7.2.20.7 request-power-state (type1 keyword)

3254 This REQUIRED member attribute specifies the requested stable or ephemeral (transitional)
 3255 power state for this calendar policy and is semantically equivalent to the RequestPowerState
 3256 element in the Power Calendar group defined in [PWG5106.4].

3257 Standard values and constraints on vendor extension values are defined in section 7.2.1
 3258 Power States and Policies.

3259 7.2.20.8 run-once (boolean)

3260 This REQUIRED member attribute specifies whether this calendar policy should be run once
 3261 (single execution) or repeatedly (multiple executions) and is semantically equivalent to the
 3262 CalendarRunOnce element in the Power Calendar group defined in [PWG5106.4].

3263 7.2.21 power-event-policy-col (1setOf collection)

3264 This OPTIONAL System attribute lists the configured System event-based power state
 3265 change policies and is semantically equivalent to the Power Event group defined in
 3266 [PWG5106.4].

3267 For example, an automated System power state transition to 'standby' upon every 'jam'
 3268 condition could be scheduled in "power-event-policy-col" as follows:

```
3269     event-id=11           # arbitrary unique value for event policy
3270     event-name='jam'      # name of event
3271     request-power-state='standby'
3272                        # target power state
```

3273 7.2.21.1 event-id (integer(1:MAX))

3274 This REQUIRED member attribute contains the unique key of this event policy and is
 3275 semantically equivalent to the EventID element in the Power Event group defined in
 3276 [PWG5106.4].

3277 7.2.21.2 event-name (name(127))

3278 This REQUIRED member attribute specifies the trigger event name of this event policy and
 3279 is semantically equivalent to the EventName element in the Power Event group defined in
 3280 [PWG5106.4].

3281 Event names MUST be either: (a) the exact case-sensitive label (starting with a lowercase
 3282 character) of an enumerated value in the `PrtAlertCodeTC` textual convention in the IANA
 3283 Printer MIB [IANAPRT] (e.g., 'jam'); or (b) a case-sensitive vendor event name (starting with
 3284 an uppercase character, e.g., 'ExamplePowerEvent'). Event names MUST be specified in
 3285 US-ASCII [ISO646] (for interoperability).

3286 **7.2.21.3 request-power-state (type1 keyword)**

3287 This REQUIRED member attribute specifies the requested stable or ephemeral (transitional)
 3288 power state for this event policy and is semantically equivalent to the `RequestPowerState`
 3289 element in the Power Event group defined in [PWG5106.4].

3290 Standard values and constraints on vendor extension values are defined in section 7.2.1
 3291 Power States and Policies.

3292 **7.2.22 power-timeout-policy-col (1setOf collection)**

3293 This RECOMMENDED System attribute lists the configured System timeout-based power
 3294 state change policies and is semantically equivalent to the Power Timeout group defined in
 3295 [PWG5106.4].

3296 For example, an automated System power state transition to 'standby' upon 5 minutes of
 3297 inactivity in 'on' power state could be scheduled in "power-timeout-policy-col" as follows:

```
3298     request-power-state='standby'
3299                               # target power state
3300     start-power-state='on'    # starting power state
3301     timeout-id=23             # arbitrary unique value for timeout policy
3302     timeout-predicate='inactivity'
3303                               # predicate of system inactivity
3304     timeout-seconds=300       # duration before transition to target power state
```

3305 **7.2.22.1 request-power-state (type1 keyword)**

3306 This REQUIRED member attribute specifies the requested stable or ephemeral (transitional)
 3307 power state for this timeout policy and is semantically equivalent to the `RequestPowerState`
 3308 element in the Power Timeout group defined in [PWG5106.4].

3309 Standard values and constraints on vendor extension values are defined in section 7.2.1
 3310 Power States and Policies.

3311 **7.2.22.2 start-power-state (type1 keyword)**

3312 This REQUIRED member attribute specifies the trigger starting stable power state for this
 3313 timeout policy and is semantically equivalent to the `StartPowerState` element in the Power
 3314 Timeout group defined in [PWG5106.4]. Note: Ephemeral (transitional) power states cannot
 3315 be specified as triggers for timeout policies.

3316 Standard values and constraints on vendor extension values for stable power states are
3317 defined in section 7.2.1 Power States and Policies.

3318 **7.2.22.3 timeout-id (integer(1:MAX))**

3319 This REQUIRED member attribute contains the unique key of this timeout policy and is
3320 semantically equivalent to the TimeoutID element in the Power Timeout group defined in
3321 [PWG5106.4].

3322 **7.2.22.4 timeout-predicate (type1 keyword)**

3323 This REQUIRED member attribute specifies the trigger predicate (i.e., pre-condition) for this
3324 timeout policy and is semantically equivalent to the TimeoutPredicate element in the Power
3325 Timeout group defined in [PWG5106.4].

3326 The standard keyword values for this attribute are:

3327 ‘activity’ (i.e., incoming Job, console input, etc.)

3328 ‘inactivity’ (i.e., no incoming, queued, or processing Jobs, console input, etc.)

3329 ‘none’

3330 **7.2.22.5 timeout-seconds (integer(0:MAX))**

3331 This REQUIRED member attribute specifies the trigger timeout interval in seconds (or zero
3332 for an immediate trigger controlled by the other trigger member attributes) for this timeout
3333 policy and is semantically equivalent to the TimeoutSeconds element in the Power
3334 Timeout group defined in [PWG5106.4].

3335 **7.2.23 printer-creation-attributes-supported (1setOf keyword)**

3336 This REQUIRED System attribute lists Printer Description attributes supported for the
3337 Create-Printer operation and is semantically analogous to the “job-creation-attributes-
3338 supported” Printer Description attribute defined in [PWG5100.11]. Table 9 lists the minimum
3339 Printer Description attributes that SHOULD be included in this attribute.

3340 **Table 9 – Common Printer Creation Attributes**

IPP Attribute Name	Reference
document-format-default	[RFC8011]
document-format-supported	[RFC8011]
multiple-document-jobs-supported	[RFC8011]
natural-language-configured	[RFC8011]
printer-geo-location	[PWG5100.13]
printer-info	[RFC8011]
printer-location	[RFC8011]
printer-make-and-model	[RFC8011]

printer-name

[RFC8011]

3341 **7.2.24 printer-service-type-supported (1setOf type2 keyword)**

3342 This REQUIRED System attribute lists the supported "printer-service-type" values for the
3343 Create-Printer (section 6.3.1) operation.

3344 **7.2.25 resource-format-supported (1setOf mimeType)**

3345 This REQUIRED System attribute lists Resource formats supported for Send-Resource-
3346 Data operations and is semantically analogous to the "document-format-supported" attribute
3347 defined in [RFC8011].

3348 **7.2.26 resource-type-supported (1setOf type2 keyword)**

3349 This REQUIRED System attribute lists Resource types supported for Create-Resource and
3350 Send-Resource-Data operations and is semantically analogous to the "document-format-
3351 supported" attribute defined in [RFC8011].

3352 **7.2.27 resource-settable-attributes-supported (1setOf keyword)**

3353 This REQUIRED System attribute lists Resource Description attributes supported for
3354 READ-WRITE access and can be configured by an Operator or Administrator. See
3355 "system-strings-languages-supported" and "system-strings-uri" below for Client localization
3356 support.

3357 **7.2.28 system-current-time (dateTime)**

3358 This REQUIRED System attribute specifies the current date and time for the System and is
3359 semantically equivalent to the CurrentTime element defined in [PWG5108.06].

3360 **7.2.29 system-default-printer-id (integer(1:65535) | no-value)**

3361 This REQUIRED System attribute identifies the unique identifier of the default Print Service
3362 configured by the Operator, Administrator, or manufacturer (used by the End User operation
3363 Get-Printer-Attributes defined in this specification) and is semantically analogous to the
3364 "printer-uri-supported" and "job-printer-uri" attributes defined in [RFC8011]. When a System
3365 has no configured Print Services, that System MUST return the 'no-value' out-of-band value
3366 defined in [RFC8011] for "system-default-printer-id". For a related use case, see section
3367 3.2.5 Bootstrap Client Access to Default Print Service.

3368 Note: When the first Print Service is created on a System, the System MUST set the value
3369 of "system-default-printer-id" to reference that Print Service.

3370 **7.2.30 system-device-id (text(MAX))**

3371 **Editor's note: Do we even want this attribute?**

3372 This REQUIRED System attribute specifies the IEEE 1284 Device ID of the overall System
3373 as defined in [IEEE1284] and further refined in [PWG5107.2] and is semantically analogous
3374 to the "printer-device-id" Printer attribute defined in [PWG5107.2].

3375 **7.2.31 system-geo-location (uri | unknown)**

3376 This REQUIRED System attribute specifies the System geographic location using the "geo:"
3377 URI scheme [RFC5870] and is semantically analogous to the "printer-geo-location" Printer
3378 attribute defined in [PWG5100.13]. When the location is unknown, Systems MUST return
3379 the 'unknown' out-of-band value defined in [RFC8011]. Systems MUST allow the Operator
3380 or Administrator to configure the geographic location manually.

3381 **7.2.32 system-info (text(127))**

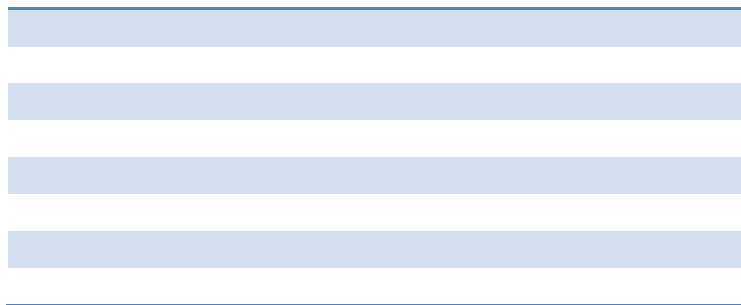
3382 This REQUIRED System attribute specifies System descriptive information, e.g., "This
3383 System can be used for printing color transparencies for HR presentations," and is
3384 semantically analogous to the "printer-info" Printer attribute defined in [RFC8011].

3385 **7.2.33 system-location (text(127))**

3386 This REQUIRED System attribute identifies the System location, e.g., "This System is in
3387 Room 123A, second floor of building XYZ," and is semantically analogous to the "printer-
3388 location" Printer attribute defined in [RFC8011].

3389 **7.2.34 system-mandatory-printer-attributes (1setOf type2 keyword)**

3390 This REQUIRED System attribute identifies the mandatory-to-supply Printer Description
3391 attributes for a Create-Printer operation on this System and is semantically analogous to the
3392 "printer-mandatory-job-attributes" Printer Description attribute defined in [PWG5100.13].
3393 This REQUIRED System attribute lists the minimum Printer and operation attributes that are
3394 required for a successful Create-Printer operation. The System MUST include in this
3395 attribute the 'printer-name' value.



3397 **7.2.35 system-make-and-model (text(127))**

3398 This REQUIRED System attribute identifies the System make and model and is semantically
3399 analogous to the "printer-make-and-model" Printer attribute defined in [RFC8011]. The
3400 manufacturer can initially populate this attribute.

3401 **7.2.36 system-message-from-operator (text(127))**

3402 This OPTIONAL System attribute provides a message from an Operator, Administrator, or
 3403 "intelligent" process to indicate the reasons for modification or other System management
 3404 action and is semantically analogous to the "printer-message-from-operator" Printer attribute
 3405 defined in [RFC8011].

3406 **7.2.37 system-name (name(127))**

3407 This REQUIRED System attribute contains the System name and is semantically analogous
 3408 to the "printer-name" Printer attribute defined in [RFC8011].

3409 **7.2.38 system-owner-col (collection | unknown)**

3410 This REQUIRED System attribute identifies the System Owner. Table 10 lists the "system-
 3411 owner-col" member attributes. When specified in a Set-System-Attributes operation, the
 3412 collection value MUST contain all REQUIRED member attributes as the entire collection
 3413 value is replaced.

3414 **Table 10: "xxx-owner-col" Member Attributes**

Conformance	Member Attribute
???	owner-uri (uri)
???	owner-name (name(MAX))
???	owner-vcard (1setOf text(MAX))

3415

3416 **7.2.38.1 owner-uri (uri)**

3417 This REQUIRED/RECOMMENDED/OPTIONAL member attribute contains a System Owner
 3418 URI, e.g., "mailto:bob@example.com," and is semantically analogous to the Service object's
 3419 OwnerURI defined in [PWG5108.01].

3420 **7.2.38.2 owner-name (name(MAX))**

3421 This REQUIRED/RECOMMENDED/OPTIONAL member attribute contains the name of the
 3422 System Owner, e.g., "Bob Smith".

3423 **7.2.38.3 owner-vcard (1setOf text(MAX))**

3424 This REQUIRED/RECOMMENDED/OPTIONAL member attribute contains a System Owner
 3425 vCard [RFC6350] and is semantically analogous to the Service object's OwnerVCard
 3426 defined in [PWG5108.01].

3427 **7.2.39 system-settable-attributes-supported (1setOf keyword)**

3428 This REQUIRED System attribute lists the System Description attributes that can be
 3429 changed using the Set-System-Attributes operation (section 6.3.15). The 'none' value can

3430 be returned by itself to indicate that no System Description attributes can be changed. See
3431 “system-strings-languages-supported” and “system-strings-uri” below for Client localization
3432 support.

3433 **7.2.40 system-strings-languages-supported (1setOf naturalLanguage)**

3434 This RECOMMENDED System attribute lists natural languages supported for the “system-
3435 strings-uri” System attribute and is semantically analogous to the “printer-strings-languages-
3436 supported” Printer attribute defined in [PWG5100.13].

3437 This attribute MUST be supported if the “system-strings-uri” attribute is supported.

3438 **7.2.41 system-strings-uri (uri | no-value)**

3439 This RECOMMENDED System attribute provides a “text/strings” message catalog file using
3440 “http:” or “https:” URIs that SHOULD be System-resident so that Client interaction with the
3441 System does not require access to external networks and is semantically analogous to the
3442 “printer-strings-uri” Printer attribute defined in [PWG5100.13]. Systems SHOULD provide
3443 localizations for all supported System attributes, keywords, and enums, so that a Client may
3444 present a consistent user interface to the User.

3445 This attribute MUST be supported if the “system-strings-uri” attribute is supported.

3446 **7.2.42 system-xri-supported (1setOf collection)**

3447 This REQUIRED System attribute lists supported XRI (URI, authentication, and security
3448 tuples) for the System and is semantically analogous to the “printer-xri-supported” Printer
3449 attribute defined in [RFC3380] and semantically analogous to Service object’s XriSupported
3450 defined in [PWG5108.01].

3451 **7.2.42.1 xri-uri (uri)**

3452 This REQUIRED member attribute specifies an “ipp:” [RFC3510] or “ipps:” [RFC7472] URI
3453 for the System and is semantically analogous to a value of the “xri-uri” member attribute
3454 defined in [RFC3380].

3455 **7.2.42.2 xri-authentication (type2 keyword)**

3456 This REQUIRED member attribute specifies the IPP Client authentication mechanism
3457 associated with the corresponding value of “xri-uri” and is semantically analogous to a value
3458 of the “xri-authentication” member attribute defined in [RFC3380]. The original standard
3459 values for this attribute are defined in [RFC8011] and extension values are registered in the
3460 IANA IPP Registry [IANAIPP].

3461 **7.2.42.3 xri-security (type2 keyword)**

3462 This REQUIRED member attribute specifies the IPP transport security mechanism
3463 associated with the corresponding value of “xri-uri” and is semantically analogous to a value

3464 of the “xri-security” member attribute defined in [RFC3380]. The original standard values for
3465 this attribute are defined in [RFC8011] and extension values are registered in the IANA IPP
3466 Registry [IANAIPP].

7.3 System Status Attributes

All of the System Status attributes are READ-ONLY and cannot be changed directly by the Set-System-Attributes operation.

7.3.1 power-log-col (1setOf collection)

This RECOMMENDED System attribute lists System power log entries (for events) and is semantically equivalent to the Power Log group defined in [PWG5106.4].

Systems SHOULD minimize the number of power log entries in this attribute for reliability. Systems MUST record all final stable power state transitions in this attribute for every sequence invoked by an ephemeral requested power state such as 'reset-nmi'. Systems MAY omit intermediate state transitions invoked by such ephemeral requested states as 'reset-nmi'.

7.3.1.1 log-id (integer(1:MAX))

This REQUIRED member attribute contains the unique key of this power log entry and is semantically equivalent to the LogID element in the Power Log group defined in [PWG5106.4].

7.3.1.2 power-state (type1 keyword)

This REQUIRED member attribute identifies the recorded stable or ephemeral (transitional) power state for this power log entry and is semantically equivalent to the PowerState element in the Power Log group defined in [PWG5106.4].

Standard values and constraints on vendor extension values are defined in section 7.2.1 Power States and Policies.

7.3.1.3 power-state-date-time (dateTime)

This REQUIRED member attribute identifies the date and time of transition into the recorded power state for this power log entry and is semantically equivalent to the PowerStateDateAndTime element in the Power Log group defined in [PWG5106.4].

7.3.1.4 power-state-message (text (255))

This OPTIONAL member attribute contains a human-readable string in UTF-8 [RFC3629] that describes, explains, or qualifies the logged power state and is semantically equivalent to the PowerStateMessage element in the Power Log group defined in [PWG5106.4]. For example, "standby - System is shutting down by user request (2W)" when transitioning to final 'off-soft' power state.

Usage: This attribute: (a) MUST identify the power state; (b) SHOULD identify the method of entry to the power state, e.g., "from timeout trigger" or "from user request"; (c) SHOULD

3500 identify the nominal power consumption, e.g., “(34 watts)”; and (d) MAY include any other
3501 power-related information, e.g., “can accept jobs” or “can process jobs”.

3502 **7.3.2 power-state-capabilities-col (1setOf collection)**

3503 This OPTIONAL System attribute lists System supported power capabilities for each stable
3504 power state and is semantically equivalent to the Power Support group defined in
3505 [PWG5106.4].

3506 **7.3.2.1 can-accept-jobs (boolean)**

3507 This REQUIRED member identifies whether the System can accept new incoming Jobs in
3508 this stable power state, unless the System or has been disabled by an Operator or
3509 Administrator, and is semantically equivalent to the CanAcceptJobs element in the Power
3510 Support group defined in [PWG5106.4].

3511 **7.3.2.2 can-process-jobs (boolean)**

3512 This REQUIRED member identifies whether the System can process new incoming Jobs or
3513 existing queued Jobs in this stable power state and is semantically equivalent to the
3514 CanProcessJobs element in the Power Support group defined in [PWG5106.4].

3515 **7.3.2.3 power-active-watts (integer(0:MAX))**

3516 This REQUIRED member attribute identifies the nominal power consumption in watts for this
3517 stable power state when the System is in an active operational state (i.e., ‘processing’) and
3518 is semantically equivalent to the PowerActiveWatts element in the Power Support group
3519 defined in [PWG5106.4].

3520 **7.3.2.4 power-inactive-watts (integer(0:MAX))**

3521 This REQUIRED member attribute identifies the nominal power consumption in watts for this
3522 stable power state when the System is in an inactive operational state (i.e., ‘idle’ or ‘stopped’)
3523 and is semantically equivalent to the PowerInactiveWatts element in the Power Support
3524 group defined in [PWG5106.4].

3525 **7.3.2.5 power-state (type1 keyword)**

3526 This REQUIRED member attribute identifies a System supported stable power state that is
3527 the unique key of this power state capability entry and is semantically equivalent to the
3528 PowerState element in the Power Support group defined in [PWG5106.4].

3529 Standard values and constraints on vendor extension values are defined in section 7.2.1
3530 Power States and Policies.

3531 7.3.3 power-state-counters-col (1setOf collection)

3532 This OPTIONAL System attribute lists System power state transition counters and is
3533 semantically equivalent to the Power Counter group defined in [PWG5106.4].

3534 7.3.3.1 hibernate-transitions (integer(0:MAX))

3535 This REQUIRED member attribute contains the System lifetime number of transitions into
3536 the 'hibernate' power state and is semantically equivalent to the HibernateTransitions
3537 element in the Power Counter group defined in [PWG5106.4].

3538 7.3.3.2 on-transitions (integer(0:MAX))

3539 This REQUIRED member attribute contains the System lifetime number of transitions into
3540 the 'on' power state and is semantically equivalent to the OnTransitions element in the Power
3541 Counter group defined in [PWG5106.4].

3542 7.3.3.3 standby-transitions (integer(0:MAX))

3543 This REQUIRED member attribute contains the System lifetime number of transitions into
3544 the 'standby' power state and is semantically equivalent to the StandbyTransitions element
3545 in the Power Counter group defined in [PWG5106.4].

3546 7.3.3.4 suspend-transitions (integer(0:MAX))

3547 This REQUIRED member attribute contains the System lifetime number of transitions into
3548 the 'suspend' power state and is semantically equivalent to the SuspendTransitions element
3549 in the Power Counter group defined in [PWG5106.4].

3550 7.3.4 power-state-monitor-col (collection)

3551 This RECOMMENDED System attribute contains the System power state and is
3552 semantically equivalent to the Power General, Power Meters, and Power Monitor groups
3553 defined in [PWG5106.4].

3554 Note: Power consumption attribute values are volatile and typically change regularly at
3555 implementation-defined intervals.

3556 7.3.4.1 current-month-kwh (integer(0:MAX))

3557 This REQUIRED member attribute contains the current month's System power consumption
3558 in kilowatt hours and is semantically equivalent to the PowerCurrentMonthKWH element in
3559 the Power Meter group defined in [PWG5106.4]. The System MUST reset the value of this
3560 attribute to zero at the beginning of every month.

7.3.4.2 current-watts (integer(0:MAX))

This REQUIRED member attribute contains the current System instantaneous power consumption in watts and is semantically equivalent to the PowerCurrentWatts element in the Power Meter group defined in [PWG5106.4].

Note: The value of this attribute is typically determined by software estimation instead of actual current measurement.

7.3.4.3 lifetime-kwh (integer(0:MAX))

This REQUIRED member attribute contains the lifetime System power consumption in kilowatt hours and is semantically equivalent to the PowerLifetimeKWH element in the Power Meter group defined in [PWG5106.4].

7.3.4.4 meters-are-actual (boolean)

This REQUIRED member attribute identifies whether or not System power meter attributes are based on actual measurement (true) or software estimation (false) and is semantically equivalent to the PowerMetersAreActual element in the Power Meter group defined in [PWG5106.4].

7.3.4.5 power-state (type1 keyword)

This REQUIRED member attribute identifies the current stable or ephemeral (transitional) System power state and is semantically equivalent to the PowerState element in the Power Monitor group defined in [PWG5106.4].

Standard values and constraints on vendor extension values are defined in section 7.2.1 Power States and Policies.

7.3.4.6 power-state-message (text (255))

This OPTIONAL member attribute contains a human-readable string in UTF-8 [RFC3629] that describes, explains, or qualifies the current System power state (e.g.,) and is semantically equivalent to the PowerStateMessage element in the Power Monitor group defined in [PWG5106.4]. For example, "standby - System is shutting down by user request (2W)" when transitioning to final 'off-soft' power state.

Usage: This attribute: (a) MUST identify the power state; (b) SHOULD identify the method of entry to the power state, e.g., "from timeout trigger" or "from user request"; (c) SHOULD identify the nominal power consumption, e.g., "(34 watts)"; and (d) MAY include any other power-related information, e.g., "can accept jobs" or "can process jobs".

7.3.4.7 power-usage-is-rms-watts (boolean)

This REQUIRED member attribute identifies whether or not the power consumption properties for this System use units of Root Mean Square (RMS) watts (true) or

3595 unnormalized so-called peak watts (false) and is semantically equivalent to the
3596 PowerUsagelsRMSWatts element in the Power General group defined in
3597 [PWG5106.4].valid-request-power-states (1setOf (type1 keyword))

3598 This REQUIRED member attribute identifies all of the stable and ephemeral power states
3599 that can be requested (in policies) on this System and is semantically equivalent to the
3600 CanRequestPowerStates element in the Power General group defined in [PWG5106.4].

3601 Standard values and constraints on vendor extension values are defined in section 7.2.1
3602 Power States and Policies.

3603 **7.3.5 power-state-transitions-col (1setOf collection)**

3604 This OPTIONAL System attribute lists valid System power state transitions and is
3605 semantically equivalent to the Power Transition group defined in [PWG5106.4].

3606 **7.3.5.1 end-power-state (type1 keyword)**

3607 This REQUIRED member attribute identifies the ending stable System power state for this
3608 valid power state transition and is semantically equivalent to the EndPowerState element in
3609 the Power Transition group defined in [PWG5106.4].

3610 Standard values and constraints on vendor extension values are defined in section 7.2.1
3611 Power States and Policies.

3612 **7.3.5.2 start-power-state (type1 keyword)**

3613 This REQUIRED member attribute identifies the starting stable System power state for this
3614 valid power state transition and is semantically equivalent to the EndPowerState element in
3615 the Power Transition group defined in [PWG5106.4].

3616 Standard values and constraints on vendor extension values are defined in section 7.2.1
3617 Power States and Policies.

3618 **7.3.5.3 state-transition-seconds (integer(0:MAX))**

3619 This REQUIRED member attribute contains the nominal duration in seconds for this valid
3620 power state transition and is semantically equivalent to the StateChangeSeconds element
3621 in the Power Transition group defined in [PWG5106.4].

3622 **7.3.6 system-config-change-date-time (dateTime)**

3623 This REQUIRED System attribute contains the value of “system-current-time” (date and
3624 time) for the most recent System configuration change.

7.3.7 system-config-change-time (integer(0:MAX))

This REQUIRED System attribute contains the value of “system-up-time” (seconds since System startup) for the most recent System configuration change or zero if no System configuration change has occurred.

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

This REQUIRED System attribute contains the count of configuration changes for the System and is semantically equivalent to the SystemConfigChangeNumber element defined in [PWG5108.06] and semantically analogous to the prtGeneralConfigChanges object defined in [RFC3805]. Each time a Set-System-Attributes operation is performed that changes the value of any attribute and each time the System changes the value of any attribute outside of an operation, the System MUST increment value of the “system-config-changes” attribute by exactly one. Each time that the System performs a power cycle (from ‘off’ to ‘on’), the System MUST reset the value of this attribute to zero.

7.3.9 system-configured-printers (1setOf collection | no-value)

This REQUIRED System attribute contains the summary of all configured Printers for the System and is semantically equivalent to the ConfiguredServices element defined in [PWG5108.06]. Table 11 lists the member attributes for collection values. If there are no configured Printers for the System, the 'no-value' out-of-band value is returned.

Table 11 –“system-configured-printers” Member Attributes

Conformance	IPP Attribute Name	Reference
REQUIRED	printer-id	[PWG5100.SYS]
REQUIRED	printer-info	[RFC8011]
REQUIRED	printer-is-accepting-jobs	[RFC8011]
REQUIRED	printer-name	[RFC8011]
REQUIRED	printer-service-type	[PWG5100.SYS]
REQUIRED	printer-state	[RFC8011]
REQUIRED	printer-state-reasons	[RFC8011]
REQUIRED	printer-xri-supported	[RFC3380]

7.3.9.1 printer-id (integer(1:65535))

This REQUIRED member attribute uniquely identifies the Printer within the System and is semantically equivalent to the ServiceSummary element ID defined in [PWG5108.06] and semantically analogous to the “job-id” attribute defined in [RFC8011]. See “printer-id” in section 7.6.2.

3649 7.3.9.2 printer-info (text(127))

3650 This REQUIRED member attribute contains the description of the Printer and is semantically
3651 equivalent to the "printer-info" Printer attribute defined in [RFC8011] but is not included in
3652 the ServiceSummary element defined in [PWG5108.06].

3653 7.3.9.3 printer-is-accepting-jobs (boolean)

3654 This REQUIRED member attribute identifies whether the Printer is currently accepting
3655 incoming Jobs and is semantically equivalent to the "printer-is-accepting-jobs" Printer
3656 attribute defined in [RFC8011] and semantically equivalent to the ServiceSummary element
3657 IsAcceptingJobs defined in [PWG5108.06].

3658 7.3.9.4 printer-name (name(127))

3659 This REQUIRED member attribute identifies the name of the Printer and is semantically
3660 equivalent to the "printer-name" Printer attribute defined in [RFC8011] and semantically
3661 equivalent to the ServiceSummary element ServiceName defined in [PWG5108.06].

3662 7.3.9.5 printer-service-type (type2 keyword)

3663 This REQUIRED member attribute identifies the service type of the Printer and is
3664 semantically equivalent to the "printer-service-type" Printer attribute defined in section 7.6.9
3665 and semantically equivalent to the ServiceSummary element ServiceType defined in
3666 [PWG5108.06].

3667 7.3.9.6 printer-state (type1 enum)

3668 This REQUIRED member attribute contains the current state of the Printer and is
3669 semantically equivalent to the "printer-state" Printer attribute defined in [RFC8011] and
3670 semantically equivalent to the ServiceSummary element State defined in [PWG5108.06].

3671 7.3.9.7 printer-state-reasons (1setOf type2 keyword)

3672 This REQUIRED member attribute contains additional detail about the current state of the
3673 Printer and is semantically equivalent to the "printer-state-reasons" Printer attribute defined
3674 in [RFC8011] and semantically equivalent to the ServiceSummary element StateReasons
3675 defined in [PWG5108.06].

3676 7.3.9.8 printer-xri-supported (1setOf collection)

3677 This REQUIRED member attribute lists the supported URI, authentication, and security
3678 tuples for the Printer and is semantically equivalent to the "printer-xri-supported" Printer
3679 attribute defined in [RFC3380] and semantically equivalent to the ServiceSummary element
3680 ServiceXriSupported defined in [PWG5108.06].

7.3.10 system-configured-resources (1setOf collection | no-value)

This REQUIRED System attribute contains the summary of all configured Resources for the System and is semantically equivalent to the ConfiguredResources element defined in [PWG5108.06]. Table 12 list the member attributes for collection values. If there are no configured Resources for the System, the 'no-value' out-of-band value is returned.

Table 12 – "system-configured-resources" Member Attributes

Conformance	IPP Attribute Name	Reference
REQUIRED	resource-format	[PWG5100.SYS]
REQUIRED	resource-id	[PWG5100.SYS]
REQUIRED	resource-info	[PWG5100.SYS]
REQUIRED	resource-name	[PWG5100.SYS]
REQUIRED	resource-state	[PWG5100.SYS]
REQUIRED	resource-state-reasons	[PWG5100.SYS]
REQUIRED	resource-type	[PWG5100.SYS]

7.3.10.1 resource-format (mimeMediaType)

This REQUIRED member attribute identifies the format of the Resource and is semantically equivalent to the "resource-format" Resource attribute defined in section 7.8.5 and semantically equivalent to the ResourceSummary element ResourceFormat defined in [PWG5108.06].

7.3.10.2 resource-id (integer(1:MAX))

This REQUIRED member attribute contains the unique identifier of the Resource and is semantically equivalent to the "resource-id" Resource attribute defined in section 7.8.6 and semantically equivalent to the ResourceSummary element ResourceId defined in [PWG5108.06].

7.3.10.3 resource-info (text(127))

This REQUIRED member attribute contains the description of the Resource and is semantically equivalent to the "resource-info" Resource attribute defined in section 7.7.1 but is not included in the original ResourceSummary element defined in [PWG5108.06].

7.3.10.4 resource-name (name(127))

This REQUIRED member attribute identifies the name of the Resource and is semantically equivalent to the "resource-name" Resource attribute defined in section 7.7.2 and semantically equivalent to the ResourceSummary element ResourceName defined in [PWG5108.06].

3706 7.3.10.5 resource-state (type1 enum)

3707 This REQUIRED member attribute contains the current state of the Resource and is
 3708 semantically equivalent to the "resource-state" Resource attribute defined in section 7.8.8
 3709 but is not included in the original ResourceSummary element defined in [PWG5108.06].

3710 7.3.10.6 resource-state-reasons (1setOf type2 keyword)

3711 This REQUIRED member attribute contains a list of state reasons for the Resource and is
 3712 semantically equivalent to the "resource-state-reasons" Resource attribute defined in section
 3713 7.8.10 but is not included in the original Resource object defined in [PWG5108.03].

3714 7.3.10.7 resource-type (type2 keyword)

3715 This REQUIRED member attribute identifies the type of the Resource and is semantically
 3716 equivalent to the "resource-type" Resource attribute defined in section 7.8.12 and
 3717 semantically equivalent to the ResourceSummary element ResourceType defined in
 3718 [PWG5108.06].

3719 7.3.11 system-impressions-completed (integer(0:MAX))

3720 This RECOMMENDED System attribute provides the total number of impressions processed
 3721 by all configured Printers, corresponding to the icImpressionTotalImps property defined in
 3722 the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3].

3723 7.3.12 system-impressions-completed-col (collection)

3724 This RECOMMENDED System attribute provides a breakdown of the total number of
 3725 impressions processed by all configured Printers. Table 13 lists the member attributes that
 3726 correspond to the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3]
 3727 properties.

3728 Table 13 - "xxx-impressions-completed-col" Member Attributes

IPP Member Attribute	Counter MIB Equivalent
blank (integer(0:MAX))	icImpressionBlankImps
blank-two-sided (integer(0:MAX))	icTwoSidedBlankImps
full-color (integer(0:MAX))	icImpressionFullColorImps
full-color-two-sided (integer(0:MAX))	icTwoSidedFullColorImps
highlight-color (integer(0:MAX))	icImpressionHighlightColorImps
highlight-color-two-sided (integer(0:MAX))	icTwoSidedHighlightColorImps
monochrome (integer(0:MAX))	icImpressionMonochromeImps
monochrome-two-sided (integer(0:MAX))	icTwoSidedMonochromeImps

7.3.13 system-media-sheets-completed (integer(0:MAX))

This RECOMMENDED System attribute provides the total number of media sheets processed by all configured Printers, corresponding to the `icMediaUsedTotalSheets` property defined in the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3].

7.3.14 system-media-sheets-completed-col (collection)

This RECOMMENDED System attribute provides a breakdown of the total number of media sheets processed by all configured Printers. Table 14 lists the member attributes that correspond to the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3] properties.

Table 14 - "xxx-media-sheets-completed-col" Member Attributes

IPP Member Attribute	Counter MIB Equivalent
blank (integer(0:MAX))	icMediaUsedBlankSheets
full-color (integer(0:MAX))	icMediaUsedFullColorSheets
highlight-color (integer(0:MAX))	icMediaUsedHighlightColorSheets
monochrome (integer(0:MAX))	icMediaUsedMonochromeSheets

7.3.15 system-pages-completed (integer(0:MAX))

This RECOMMENDED System attribute provides the total number of pages processed by all configured Printers, corresponding to the `icImpressionTotalImps` property defined in the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3].

7.3.16 system-pages-completed-col (collection)

This RECOMMENDED System attribute provides a breakdown of the total number of pages processed by all configured Printers. Table 15 lists the member attributes that correspond to the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3] properties.

Table 15 - "xxx-pages-completed-col" Member Attributes

IPP Member Attribute	Counter MIB Equivalent
full-color (integer(0:MAX))	icImageMonochromeImages
monochrome (integer(0:MAX))	icImageFullColorImages

7.3.17 system-serial-number (text(255))

This OPTIONAL System attribute identifies the serial number for the System and is semantically equivalent to the `SerialNumber` element defined in [PWG5108.06] and semantically analogous to the `prtGeneralSerialNumber` element defined in [RFC3805].

3752 7.3.18 system-state (type1 enum)

3753 This REQUIRED System attribute contains the current state for the System and is
3754 semantically equivalent to the State element defined in [PWG5108.06] and semantically
3755 analogous to the “printer-state” attribute defined in [RFC8011].

3756 Standard values for this attribute are:

3757 'idle' (3): Indicates that one or more Printers are in the 'idle' state and none are in
3758 the 'processing' state.

3759 'processing' (4): Indicates that one or more Printers are in the 'processing' state.

3760 'stopped' (5): Indicates that all Printers are in the 'stopped' state.

3761 7.3.19 system-state-change-date-time (dateTime)

3762 This REQUIRED System attribute contains the value of “system-current-time” (date and
3763 time) for the most recent System state change and is semantically analogous to the “printer-
3764 state-change-date-time” attribute defined in [RFC3995].

3765 7.3.20 system-state-change-time (integer(0:MAX))

3766 This REQUIRED System attribute contains the value of “system-up-time” (seconds since
3767 System startup) for the most recent System state change or zero if no System state change
3768 has occurred and is semantically analogous to the “printer-state-change-time” attribute
3769 defined in [RFC3995].

3770 7.3.21 system-state-message (text(MAX))

3771 Editor's note: There is no clear way to do roll-up of all printer-state-message values here,
3772 nor does it make much sense. Should we remove this attribute, or make it RECOMMENDED
3773 with some guidance about the value? 5108.06 makes this the equivalent of a "system-state-
3774 messages (1setOf text(MAX))" attribute but provides no guidance.

3775 This REQUIRED System attribute contains a state message for the System and is
3776 semantically analogous to the StateMessages element defined in [PWG5108.06] and
3777 semantically analogous to the “printer-state-message” attribute defined in [RFC8011].

3778 7.3.22 system-state-reasons (1setOf type2 keyword)

3779 This REQUIRED System attribute contains a list of state reasons for the System and is
3780 semantically equivalent to the StateReasons element defined in [PWG5108.06] and
3781 semantically analogous to the “printer-state-reasons” attribute defined in [RFC8011]. Any
3782 applicable “printer-state-reasons” keyword value can be used in “system-state-reasons”.

3783 Editor's note: We need to provide guidance on how to do roll-up of the "printer-state-reasons"
3784 values.

3785 7.3.23 system-up-time (integer(1:MAX))

3786 This REQUIRED System attribute contains the time in seconds since last boot for the
3787 System and is semantically equivalent to the UpTime element defined in [PWG5108.06].

3788 7.3.24 system-uuid (uri(45))

3789 This REQUIRED System attribute identifies the UUID as a URI [RFC4122] for the System
3790 and is semantically equivalent to the ServiceUuid element defined in [PWG5108.01].

3791 7.3.25 xri-authentication-supported (1setOf type2 keyword)

3792 This REQUIRED System attribute lists the supported "xri-authentication" member attribute
3793 values and is semantically equivalent to the Printer Status attribute of the same name.

3794 7.3.26 xri-security-supported (1setOf type2 keyword)

3795 This REQUIRED System attribute lists the supported "xri-security" member attribute values
3796 and is semantically equivalent to the Printer Status attribute of the same name.

3797 7.3.27 xri-uri-scheme-supported (1setOf uriScheme)

3798 This REQUIRED System attribute lists the supported "xri-uri" member attribute URI schemes
3799 and is semantically equivalent to the Printer Status attribute of the same name.

3800 7.4 Job Status Attributes

3801 All Job Status attributes are READ-ONLY and cannot be directly updated by the Set-Job-
3802 Attributes operation.

3803 7.4.1 job-owner-col (collection | unknown)

3804 This RECOMMENDED Job attribute identifies the Job Owner. Table 10 lists the "job-owner-
3805 col" member attributes, which are the same as the "system-owner-col" System Description
3806 attribute (section 7.2.38).

3807 7.4.2 job-resource-ids (1setOf integer(1:MAX))

3808 This REQUIRED Job attribute lists the Printer resource IDs allocated to the Job. The value(s)
3809 are the actual resource IDs copied from the "job-resource-ids" (section 7.1.1) operation
3810 attribute from the Job Creation request.

3811 7.5 Printer Description Attributes

3812 Printer Description attributes are typically READ-WRITE and can potentially be set by an
3813 Operator or Administrator using the Set-Printer-Attributes operation [RFC3380]. Writable

3814 Printer Description attributes are listed in the value of “printer-settable-attributes-supported”
3815 [RFC3380].

3816 **7.5.1 printer-owner-col (collection | unknown)**

3817 This REQUIRED Printer attribute identifies the Printer Owner. Table 10 lists the "printer-
3818 owner-col" member attributes, which are the same as the "system-owner-col" System
3819 Description attribute (section 7.2.38).

3820 **7.6 Printer Status Attributes**

3821 All of the Printer Status attributes are READ-ONLY and cannot be set directly by the Set-
3822 Printer-Attributes operation.

3823 **7.6.1 printer-config-changes (integer(0:MAX))**

3824 This REQUIRED Printer attribute identifies the number of configuration changes (in Printer
3825 Description attributes) for a Printer semantically equivalent to the Monitoring element
3826 ConfigChanges defined in [PWG5106.1] and semantically equivalent to
3827 “prtGeneralConfigChanges” in IETF Printer MIB v2 [RFC3805]. The value of this attribute
3828 MUST be incremented by one for each operation that changes the Printer configuration
3829 (rather than incrementing by one for each configuration attribute that was changed by the
3830 single operation).

3831 **7.6.2 printer-id (integer(1:65535))**

3832 This REQUIRED Printer attribute uniquely identifies the Printer within the System and is
3833 semantically equivalent to the ServiceSummary element ID defined in [PWG5108.06] and
3834 semantically analogous to the “job-id” attribute defined in [RFC8011].

3835 **7.6.3 printer-impressions-completed (integer(0:MAX))**

3836 This RECOMMENDED Printer attribute provides the total number of impressions processed
3837 by the Printer, corresponding to the icImpressionTotalImps property defined in the PWG
3838 Imaging System State and Counter MIB v2.0 [PWG5106.3].

3839 **7.6.4 printer-impressions-completed-col (collection)**

3840 This RECOMMENDED Printer attribute provides a breakdown of the total number of
3841 impressions processed by the Printer. Table 13 lists the member attributes that correspond
3842 to the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3] properties.

3843 **7.6.5 printer-media-sheets-completed (integer(0:MAX))**

3844 This RECOMMENDED Printer attribute provides the total number of media sheets
3845 processed by the Printer, corresponding to the icMediaUsedTotalSheets property defined in
3846 the PWG Imaging System State and Counter MIB v2.0 [PWG5106.3].

3847 7.6.6 printer-media-sheets-completed-col (collection)

3848 This RECOMMENDED Printer attribute provides a breakdown of the total number of media
3849 sheets processed by the Printer. Table 14 lists the member attributes that correspond to the
3850 PWG Imaging System State and Counter MIB v2.0 [PWG5106.3] properties.

3851 7.6.7 printer-pages-completed (integer(0:MAX))

3852 This RECOMMENDED Printer attribute provides the total number of pages processed by
3853 the Printer, corresponding to the `iclmpressionTotalImps` property defined in the PWG
3854 Imaging System State and Counter MIB v2.0 [PWG5106.3].

3855 7.6.8 printer-pages-completed-col (collection)

3856 This RECOMMENDED Printer attribute provides a breakdown of the total number of pages
3857 processed by the Printer. Table 15 lists the member attributes that correspond to the PWG
3858 Imaging System State and Counter MIB v2.0 [PWG5106.3] properties.

3859 7.6.9 printer-service-type (type2 keyword)

3860 This REQUIRED Printer attribute identifies the service type for a Printer as used in Create-
3861 Printer defined in section 6 and is semantically equivalent to the Service Summary element
3862 `ServiceType` defined in [PWG5108.06]. Vendor-specific service types SHOULD be
3863 keywords constructed in the form “`smiNNN-name`”, where “NNN” is the vendor’s enterprise
3864 SMI number assigned by IANA. Vendor-specific service types SHOULD be registered with
3865 IANA.

3866 Standard keyword values for this attribute include:

3867 ‘copy’: A Copy service defined in [PWG5108.04].

3868 ‘faxin’: A FaxIn service defined in [RFC2707] and [PWG5108.01].

3869 ‘faxout’: A FaxOut service defined in [PWG5100.15].

3870 ‘print’: A Print service defined in [RFC8011].

3871 ‘print3d’: A 3D Print service defined in [PWG5100.21]

3872 ‘scan’: A Scan service defined in [PWG5100.17].

3873 ‘transform’: A Transform service defined in [PWG5108.01].

3874 7.7 Resource Description Attributes

3875 Resource Description attributes are typically READ-WRITE and can potentially be set by an
3876 Operator or Administrator using the Set-Resource-Attributes operation (see section 6).

3877 Writable Resource Description attributes are listed in the value of “resource-settable-
3878 attributes-supported” System Description attribute defined above in section 7.2.

3879 **7.7.1 resource-info (text(MAX))**

3880 This REQUIRED Resource attribute contains the description of the Resource and is
3881 semantically equivalent to the ResourceInfo element defined in [PWG5108.03] and
3882 semantically analogous to the "printer-info" Printer attribute defined in [RFC8011].

3883 **7.7.2 resource-name (name(MAX))**

3884 This REQUIRED Resource attribute contains the name of the Resource and is semantically
3885 equivalent to the ResourceName element defined in [PWG5108.03] and semantically
3886 analogous to the "printer-name" Printer attribute defined in [RFC8011].

3887 **7.7.3 resource-owner-col (collection | unknown)**

3888 This REQUIRED Resource attribute identifies the Resource Owner. Table 10 lists the
3889 "resource-owner-col" member attributes, which are the same as the "system-owner-col"
3890 System Description attribute (section 7.2.38).

3891 **7.8 Resource Status Attributes**

3892 All of the Resource Status attributes are READ-ONLY and cannot be directly updated by the
3893 Set-Resource-Attributes operation.

3894 **7.8.1 date-time-at-canceled (dateTime | no-value)**

3895 This REQUIRED Resource attribute contains the date and time of Resource cancelation
3896 request (i.e., when Cancel-Resource operation is accepted) or Resource abortion by the
3897 System, which can be before the Resource transitions to the ‘canceled’ or ‘aborted’ state. It
3898 is semantically analogous to the DateTimeAtExpiration element defined in [PWG5108.03]
3899 and semantically analogous to the Job “date-time-at-completed” attribute defined in
3900 [RFC8011]. If the Resource has not been canceled or aborted, the 'no-value' out-of-band
3901 value is returned.

3902 **7.8.2 date-time-at-creation (dateTime)**

3903 This REQUIRED Resource attribute contains the date and time of Resource creation request
3904 (i.e., when Create-Resource operation is accepted) and is semantically equivalent to the
3905 DateTimeAtCreation element defined in [PWG5108.03] and semantically analogous to the
3906 “date-time-at-creation” Job attribute defined in [RFC8011].

3907 **7.8.3 date-time-at-installed (dateTime | no-value)**

3908 This REQUIRED Resource attribute contains the date and time of Resource installation
3909 request (i.e., when Install-Resource operation is accepted), which can be before the

3910 Resource transitions to the 'installed' state. It is semantically analogous to the "date-time-at-
3911 processing" Job attribute defined in [RFC8011]. If the Resource has not been installed, the
3912 'no-value' out-of-band value is returned.

3913 **7.8.4 resource-data-uri (uri | no-value))**

3914 This REQUIRED Resource attribute identifies the URI of the Resource data (if any) and is
3915 semantically equivalent to the ResourceFormat element defined in [PWG5108.03] and
3916 semantically analogous to the "document-format" attribute defined in [RFC8011]. When a
3917 Resource has no associated data, the System MUST return the 'no-value' out-of-band value
3918 defined in [RFC8011] for "resource-data-uri".

3919 **7.8.5 resource-format (mimeMediaType)**

3920 This REQUIRED Resource attribute identifies the format of the Resource data and is
3921 semantically equivalent to the ResourceFormat element defined in [PWG5108.03] and
3922 semantically analogous to the "document-format" attribute defined in [RFC8011].

3923 **7.8.6 resource-id (integer(1:MAX))**

3924 This REQUIRED Resource attribute uniquely identifies the Resource within the System and
3925 is semantically equivalent to the ResourceId element defined in [PWG5108.03] and
3926 semantically analogous to the "job-id" attribute defined in [RFC8011].

3927 **7.8.7 resource-k-octets (integer(0:MAX))**

3928 This REQUIRED Resource attribute contains the size of the data associated with the
3929 Resource (if any) but is not included in the original Resource object defined in [PWG5108.03]
3930 and semantically analogous to the "job-k-octets" attribute defined in [RFC8011].

3931 **7.8.8 resource-state (type1 enum)**

3932 This REQUIRED Resource attribute contains the current state of the Resource and is
3933 semantically analogous to the DateTimeOfExpiration and ResourceHasExpired elements
3934 defined in [PWG5108.03] and semantically analogous to the "job-state" attribute defined in
3935 [RFC8011].

3936 Standard enum values for this attribute are:

3937 'pending' (3): The Resource has been created but is not yet available or installed.

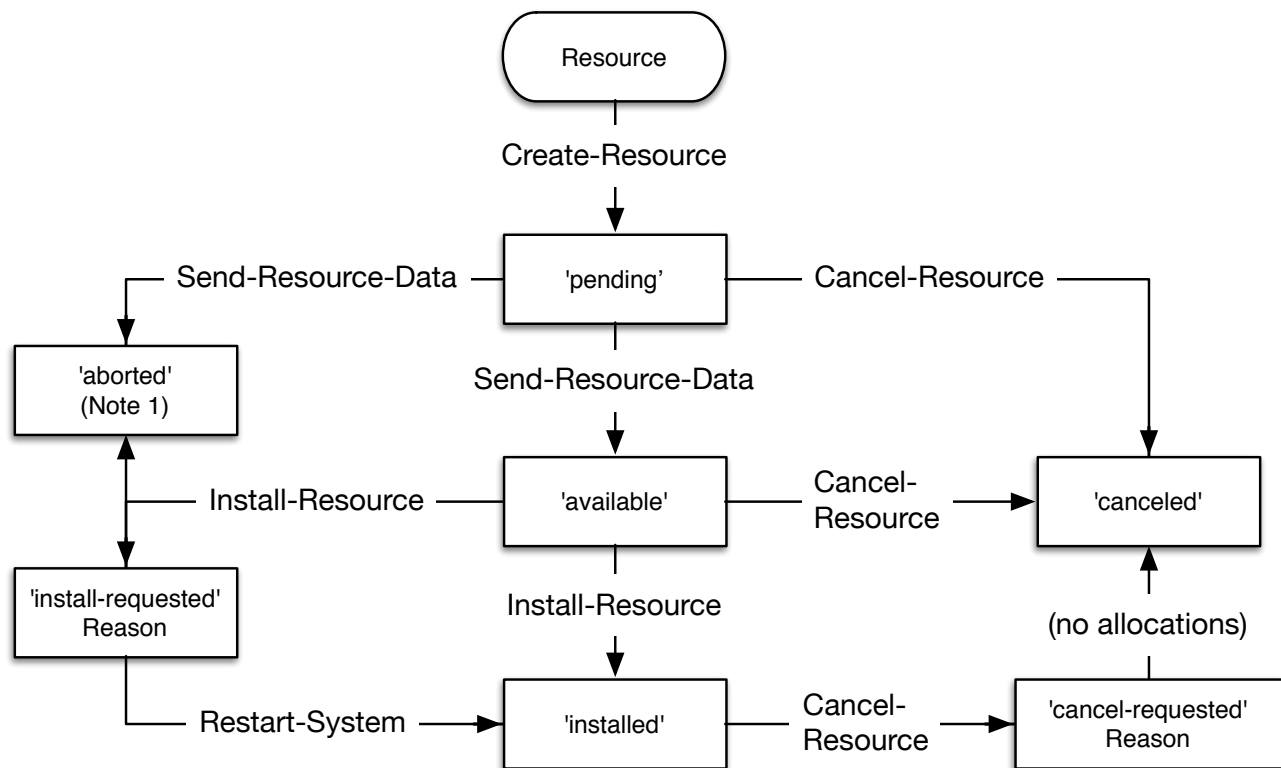
3938 'available' (4): The Resource data has been uploaded and the Resource is
3939 available for installation.

3940 'installed' (5): The Resource has been installed and is ready for use.

3941 'canceled' (6): The Resource has been canceled and can no longer be used.

3942 'aborted' (7): The Resource has been aborted by the System and can no longer be
 3943 used.

3944 Normal Resource state transitions are shown in Figure 2 below. Resource states normally
 3945 progress from top to bottom ('created' to 'available' to 'installed') until the Resource finally
 3946 transitions to a terminal state of 'canceled' (by Administrator) or 'aborted' (by System). See
 3947 note 2 below for one of the exceptions to normal Resource state transitions.



3948
 3949 **Figure 2 – IPP Resource Object Life Cycle**

3950 Notes:

- 3951 1) A Resource object can transition to the 'aborted' state due to an interrupted Send-
 3952 Resource-Data request, corrupted Resource data, an unsupported Resource data
 3953 format, inability to store the Resource data, inability to install the Resource data,
 3954 and/or other System internal fault conditions. The "resource-state-reasons" attribute
 3955 will contain the reason for the Resource being aborted by the System.
- 3956 2) When a new Resource version is installed that replaces a previous Resource
 3957 version (e.g., firmware), the old Resource "resource-state" MUST transition back to
 3958 'available' and the old Resource "resource-use-count" MUST be set to zero.

7.8.9 resource-state-message (text(MAX))

This REQUIRED Resource attribute contains a state message for the Resource but is not included in the original Resource object defined in [PWG5108.03] and semantically analogous to the “job-state-message” attribute defined in [RFC8011].

7.8.10 resource-state-reasons (1setOf type2 keyword)

This REQUIRED Resource attribute contains a list of state reasons for the Resource but is not included in the original Resource object defined in [PWG5108.03] and is semantically analogous to the “job-state-reasons” attribute defined in [RFC8011]. Any applicable “job-state-reasons” keyword value can be used in “resource-state-reasons”.

Standard values for this attribute are:

‘cancel-requested’: A Cancel-Resource operation has been received and accepted and the Resource will become permanently unavailable when the cancellation is completed (e.g., after the current Job using the Resource is completed).

‘install-requested’: An Install-Resource operation has been received and accepted and the Resource will become available for use when the installation is completed (e.g., potentially after the next System or Subunit reboot in the case of an executable Resource).

‘resource-incoming’: A Send-Resource-Data operation has been received and accepted, Resource data upload is in progress, and “resource-state” will transition to ‘available’ after the upload is completed.

7.8.11 resource-string-version (text(127))

This REQUIRED Resource attribute contains the string version of the Resource, which SHOULD conform to section 4.2.4 “String Version” of IETF PA-TNC [RFC5792] which defines the internal string fields Product Version Number, Internal Build Number, and Configuration Version Number. This attribute is semantically analogous to the FirmwareStringVersion attribute defined in [PWG5110.4].

7.8.12 resource-type (type2 keyword)

This REQUIRED Resource attribute identifies the type of the Resource and is semantically equivalent to the ResourceType element defined in [PWG5108.03].

IPP System Service implementations SHOULD support System-scope executable resources (e.g., for firmware update). System Service implementations MAY support Printer-scope and/or Job-scope executable resources in an implementation-defined manner.

Standard values for this attribute (with their resource category prefix) include:

‘executable-firmware’: Executable firmware.

- 3993 'executable-software': Executable (Printer-resident application) software.
- 3994 'static-font': Static font.
- 3995 'static-form': Static form.
- 3996 'static-icc-profile': Static ICC profile.
- 3997 'static-image': Static image such as a Printer icon.
- 3998 'static-logo': Static logo such as an organizational logo used on letterhead.
- 3999 'static-other': Static resource of some other kind.
- 4000 'static-strings': Static localization (".strings") file.
- 4001 'template-document': Template for creating Document object [PWG5100.5].
- 4002 'template-job': Template for creating Job object [PWG5108.07].
- 4003 'template-printer': Template for creating Printer object [RFC8011].

4004 **7.8.13 resource-use-count (integer(0:MAX))**

4005 This REQUIRED Resource attribute contains the use count (i.e., allocation count) for the
4006 Resource but is not included in the original Resource object defined in [PWG5108.03].

4007 Note: If the System internal use count exceeds MAX, then the System MUST return
4008 "resource-use-count" with a value of MAX.

4009 **7.8.14 resource-uuid (uri(45))**

4010 This REQUIRED Resource attribute identifies the UUID as a URI [RFC4122] for the
4011 Resource but is not included in the original Resource object defined in [PWG5108.03] and
4012 is semantically analogous to the "system-uuid" attribute defined in section 7.3.

4013 **7.8.15 resource-version (octetString(16))**

4014 This REQUIRED Resource attribute contains the numeric version of the Resource, which
4015 SHOULD conform to section 4.2.3 "Numeric Version" of IETF PA-TNC [RFC5792] which
4016 defines the internal integer fields Major Version Number, Minor Version Number, Build
4017 Number, Service Pack Major, and Service Pack Minor. This attribute is semantically
4018 analogous to the FirmwareVersion attribute defined in [PWG5110.4].

4019 **7.8.16 time-at-canceled (integer(MIN:MAX) | no-value)**

4020 This REQUIRED Resource attribute contains the time of Resource cancelation request (i.e.,
4021 when Cancel-Resource operation is accepted) or Resource abortion by the System, which

can be before the Resource transitions to the 'canceled' or 'aborted' state. It is not included in the original Resource object defined in [PWG5108.03] and is semantically analogous to the "time-at-completed" Job attribute defined in [RFC8011]. If the Resource has not been canceled or aborted, the 'no-value' out-of-band value is returned.

7.8.17 time-at-creation (integer(MIN:MAX))

This REQUIRED Resource attribute contains the time of Resource creation request (i.e., when Create-Resource operation is accepted) but is not included in the original Resource object defined in [PWG5108.03] and is semantically analogous to the "time-at-creation" Job attribute defined in [RFC8011].

7.8.18 time-at-installed (integer(MIN:MAX) | no-value)

This REQUIRED Resource attribute contains the time of Resource installation request (i.e., when Install-Resource operation is accepted), which can be before the Resource transitions to the 'installed' state. It is not included in the original Resource object defined in [PWG5108.03] and is semantically analogous to the "time-at-processing" Job attribute defined in [RFC8011]. If the Resource has not been installed, the 'no-value' out-of-band value is returned.

7.9 Subscription Status Attributes

All Subscription Status attributes are READ-ONLY.

7.9.1 notify-system-uri (uri)

This attribute provides the "system-uri" associated with the Subscription. Systems MUST support this attribute for System and Resource Subscriptions.

7.10 Event Notifications Attributes

7.10.1 notify-system-up-time (integer(0:MAX))

This attribute provides the "system-up-time" value when the event occurred. Systems MUST support this attribute for System and Resource Subscription event notifications.

7.10.2 notify-system-uri (uri)

This attribute provides the "system-uri" for the subscribed event. Systems MUST support this attribute for System and Resource Subscription event notifications.

8. Additional Semantics for Existing Operations

8.1 Cancel-Subscription, Get-Notifications, Get-Subscription-Attributes, Get-Subscriptions, Renew-Subscription: system-uri (uri)

This specification adds the "system-uri" (section 7.1.20) operation attribute to specify the target System object of the operation.

8.2 Create-Job, Print-Job, Print-URI: job-resource-ids (1setOf integer(1:MAX))

This specification adds the "job-resources-ids (1setOf integer(1:MAX))" (section 7.1.1) operation attribute to specify a list of Printer resources that are to be allocated to the created Job.

If any of the resource IDs are not allocated to the Printer, the Printer returns the "job-resource-ids" attribute with the corresponding resource IDs in the Unsupported Attributes group of the response. The returned "status-code" value will be 'successful-ok-ignored-or-substituted-attributes' or 'client-error-attributes-or-values-not-supported' depending on the requested attribute fidelity.

The successfully allocated resource IDs are copied to the corresponding "job-resource-ids" Job Status attribute (section 7.4.2).

8.3 Get-Printer-Attributes: system-uri (uri) or printer-uri (uri)

This specification adds the "system-uri" (section 7.1.20) operation attribute to specify the target System object of the operation.

When this request is sent to the System object, the System responds as if the request was sent to the default Printer for the System (section 7.2.29). If no default Printer is configured, the System responds with the 'client-error-not-found' status code.

9. Additional Values for Existing Attributes

9.1 notify-events (1setOf type2 keyword)

This specification defines the following new "notify-events" values:

'printer-created': REQUIRED - a Printer was created.

'printer-deleted': REQUIRED - a Printer was deleted.

'resource-canceled': REQUIRED - a Resource was canceled.

4080 'resource-config-changed': REQUIRED - when the configuration of the Resource is
4081 changed, i.e., when any Resource Description attribute is changed.

4082 'resource-created': REQUIRED - a Resource was created.

4083 'resource-installed': REQUIRED - a Resource was installed.

4084 'resource-state-changed': REQUIRED - the Resource changed state from any state
4085 to any other state. Specifically, the value of the Resource's "resource-state" or
4086 "resource-state-reasons" attributes change.

4087 'system-config-changed': REQUIRED - when the configuration of the System is
4088 changed, i.e., when any System Description attribute is changed.

4089 'system-restarted': OPTIONAL - when the System is booted/started up.

4090 'system-shutdown': OPTIONAL - when the System is being shut down.

4091 'system-state-changed': REQUIRED - the System changed state from any state to
4092 any other state. Specifically, the value of the System's "system-state" or "system-
4093 state-reasons" attributes changed.

4094 'system-stopped': REQUIRED - when the "system-state" is 'stopped'.

4095 **9.2 printer-state-reasons (1setOf type2 keyword)**

4096 This specification defines the following new "printer-state-reasons" values:

4097 'deleted'; The Printer has been deleted.

4098 'resuming'; The Printer is processing a Resume-Printer request.

4099 **9.3 requested-attributes (1setOf type2 keyword)**

4100 This specification defines the following new "requested-attributes" values:

4101 'resource-description': The subset of Resource Description attributes.

4102 'resource-status': The subset of Resource Status attributes.

4103 'resource-template': The subset of Resource Template attributes.

4104 'system-description': The subset of System Description attributes.

4105 'system-status': The subset of System Status attributes.

4106

10. Conformance Requirements

Provide numbered lists of conformance requirements for the document.

10.1 Conformance Requirements for Clients

In order for a Client to claim conformance to this specification, a Client MUST support:

1. The required IPP operations defined in section 6,
2. The required IPP attributes defined in section 7,
3. The internationalization considerations in section 11, and
4. The security considerations in section 12.

10.2 Conformance Requirements for Infrastructure Systems

In order for an Infrastructure System to claim conformance to this specification, an Infrastructure System MUST support:

1. The required IPP operations defined in section 6,
2. The required IPP attributes defined in section 7,
3. The additional IPP operation semantics defined in section 8,
4. The additional IPP attribute values defined in section 9,
5. The internationalization considerations in section 11, and
6. The security considerations in section 12.

10.3 Conformance Requirements for Systems

In order for a System to claim conformance to this specification, a System MUST support:

1. The required IPP operations defined in section 6,
2. The required IPP attributes defined in section 7,
3. The additional IPP operation semantics defined in section 8,
4. The additional IPP attribute values defined in section 9,
5. The internationalization considerations in section 11, and
6. The security considerations in section 12.

11. Internationalization Considerations

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

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

- 4139 • Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical
- 4140 • Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping
- 4141 • Unicode Normalization Forms [UAX15] – especially NFC for [RFC 5198]
- 4142 • Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 4143 • Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 4144 • Unicode Collation Algorithm [UTS10] – sorting
- 4145 • Unicode Locale Data Markup Language [UTS35] – locale databases

4146 Implementations of this specification are advised to also review the following informational
4147 documents on processing of human-readable Unicode text strings:

- 4148 • Unicode Character Encoding Model [UTR17] – multi-layer character model
- 4149 • Unicode in XML and other Markup Languages [UTR20] – XML usage
- 4150 • Unicode Character Property Model [UTR23] – character properties
- 4151 • Unicode Conformance Model [UTR33] – Unicode conformance basis

4152 **12. Security Considerations**

4153 The IPP extensions defined in this document require the same security considerations as
4154 defined in the IPP/1.1: Model and Semantics [RFC8011] and PWG System Object and
4155 System Control Service Semantics [PWG5108.06], plus the additional security
4156 considerations below.

4157 **12.1 Human-readable Strings**

4158 Implementations of this specification SHOULD conform to the following standard on
4159 processing of human-readable Unicode text strings, see:

- 4160 • Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

4161 Implementations of this specification are advised to also review the following informational
4162 document on processing of human-readable Unicode text strings:

- 4163 • Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

12.2 Confidentiality and Integrity

Clients and Systems MUST provide confidentiality and integrity of data in transit using either an interface providing physical security such as USB or using TLS encryption [RFC5246] over otherwise unsecured local or network connections,

12.3 Access Control

Because of the potential for abuse and misuse, Systems SHOULD provide access control mechanisms including lists of allowed Clients, authentication, and authorization for site defined policies since, except for Get-Printer-Attributes for legacy Clients, an IPP System Service consists of administrative operations for authenticated and authorized users.

12.4 Physical Safety

Systems MUST NOT allow Clients to disable physical safety features of the hardware, such as protective gates, covers, or interlocks.

12.5 Digital Signature Validation

When accepting new resource data using the Send-Resource-Data operation, the System SHOULD validate any Resource signature supplied or embedded in the Resource data, for example as described in US NIST Digital Signature Standard [FIPS186-4], ENISA Algorithms, Key Size and Parameters Report [ENISAALG], ETSI Electronic Signatures and Infrastructures (ESI) Signature validation procedures and policies [TS102853], and IETF XML-Signature Syntax and Processing [RFC3275].

In the event that the "resource-signature (1setOf octetString)" operation attribute (section 7.1.15) is specified for Resource data with an embedded signature, both signatures MUST be validated. Resource signatures MAY be re-validated at other times by the System, however such validation is outside the scope of this specification.

12.6 Encrypted Resources

Resource data can be encrypted as part of the underlying resource format. Systems SHOULD NOT decrypt such resources until they are used in order to provide the best protection at rest for those resources. Key distribution and management for such resources is outside the scope of this specification.

13. IANA Considerations

13.1 Object Registrations

The objects defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC8011] section 7.1 in the following file:

<http://www.iana.org/assignments/ipp-registrations>

The registry entries will contain the following information:

Object Name	Reference
-----	-----
Resource	[PWG5100.SYS]
System	[PWG5100.SYS]

13.2 Attribute Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP Model and Semantics [RFC8011] section 7.2 in the following file:

<http://www.iana.org/assignments/ipp-registrations>

The registry entries will contain the following information:

Operation attributes:	Reference
-----	-----
job-resource-ids (1setOf integer(1:MAX))	[PWG5100.SYS]
printer-id (integer(1:65535))	[PWG5100.SYS]
printer-ids (1setOf integer(1:65535))	[PWG5100.SYS]
printer-geo-location (uri)	[PWG5100.SYS]
printer-location (text(127))	[PWG5100.SYS]
printer-service-type (1setOf type2 keyword)	[PWG5100.SYS]
printer-xri-requested (1setOf collection)	[PWG5100.SYS]
requesting-user-vcard (1setOf text(MAX))	[PWG5100.SYS]
resource-format (mimeType)	[PWG5100.SYS]
resource-format-accepted (1setOf mimeType)	[PWG5100.SYS]
resource-formats (1setOf mimeType)	[PWG5100.SYS]
resource-id (integer(1:MAX))	[PWG5100.SYS]
resource-ids (1setOf integer(1:MAX))	[PWG5100.SYS]
resource-k-octets (integer(0:MAX))	[PWG5100.SYS]
resource-signature (1setOf octetString)	[PWG5100.SYS]
resource-states (1setOf type1 enum)	[PWG5100.SYS]
resource-type (type2 keyword)	[PWG5100.SYS]
resource-types (1setOf type2 keyword)	[PWG5100.SYS]
restart-get-interval (integer(0:MAX))	[PWG5100.SYS]
system-uri (uri)	[PWG5100.SYS]
which-printers (type2 keyword)	[PWG5100.SYS]
System Description attributes:	Reference
-----	-----

```

4233 charset-configured (charset) [PWG5100.SYS]
4234 charset-supported (1setOf charset) [PWG5100.SYS]
4235 document-format-supported (1setOf mimeType) [PWG5100.SYS]
4236 ippget-event-life (integer(15:MAX)) [PWG5100.SYS]
4237 ipp-features-supported (1setOf type2 keyword) [PWG5100.SYS]
4238 ipp-versions-supported (1setOf type2 keyword) [PWG5100.SYS]
4239 multiple-document-printers-supported (boolean) [PWG5100.SYS]
4240 natural-language-configured (naturalLanguage) [PWG5100.SYS]
4241 generated-natural-language-supported (1setOf naturalLanguage) [PWG5100.SYS]
4242 notify-attributes-supported (1setOf keyword) [PWG5100.SYS]
4243 notify-events-default (1setOf type2 keyword) [PWG5100.SYS]
4244 notify-events-supported (1setOf type2 keyword) [PWG5100.SYS]
4245 notify-lease-duration-default (integer(0:67108863)) [PWG5100.SYS]
4246 notify-lease-duration-supported (1setOf (integer(0:67108863) |
4247   rangeOfInteger(0:67108863))) [PWG5100.SYS]
4248 notify-max-events-supported (integer(2:MAX)) [PWG5100.SYS]
4249 notify-pull-method-supported (1setOf type2 keyword) [PWG5100.SYS]
4250 notify-schemes-supported (1setOf uriScheme) [PWG5100.SYS]
4251 operations-supported (1setOf type2 enum) [PWG5100.SYS]
4252 power-calendar-policy-col (1setOf collection) [PWG5100.SYS]
4253   calendar-id (integer(1:MAX)) [PWG5100.SYS]
4254   day-of-month (integer(1:31)) [PWG5100.SYS]
4255   day-of-week (integer(1:7)) [PWG5100.SYS]
4256   hour (integer(0:23)) [PWG5100.SYS]
4257   minute (integer(0:59)) [PWG5100.SYS]
4258   month (integer(1:12)) [PWG5100.SYS]
4259   request-power-state (type1 keyword) [PWG5100.SYS]
4260   run-once (boolean) [PWG5100.SYS]
4261 power-event-policy-col (1setOf collection) [PWG5100.SYS]
4262   event-id (integer(1:MAX)) [PWG5100.SYS]
4263   event-name (name(127)) [PWG5100.SYS]
4264   request-power-state (type1 keyword) [PWG5100.SYS]
4265 power-timeout-policy-col (1setOf collection) [PWG5100.SYS]
4266   start-power-state (type1 keyword) [PWG5100.SYS]
4267   timeout-id (integer(1:MAX)) [PWG5100.SYS]
4268   timeout-predicate (type1 keyword) [PWG5100.SYS]
4269   timeout-seconds (integer(0:MAX)) [PWG5100.SYS]
4270 printer-creation-attributes-supported (1setOf keyword) [PWG5100.SYS]
4271 resource-format-supported (1setOf mimeType) [PWG5100.SYS]
4272 resource-type-supported (1setOf type2 keyword) [PWG5100.SYS]
4273 resource-settable-attributes-supported (1setOf keyword) [PWG5100.SYS]
4274 system-current-time (dateTime) [PWG5100.SYS]
4275 system-default-printer-id (integer(1:65535) | no-value) [PWG5100.SYS]
4276 system-device-id (text(MAX)) [PWG5100.SYS]
4277 system-geo-location (uri | unknown) [PWG5100.SYS]
4278 system-info (text(127)) [PWG5100.SYS]
4279 system-location (text(127)) [PWG5100.SYS]
4280 system-mandatory-printer-attributes (1setOf keyword) [PWG5100.SYS]
4281 system-make-and-model (text(127)) [PWG5100.SYS]
4282 system-message-from-operator (text(127)) [PWG5100.SYS]
4283 system-name (name(127)) [PWG5100.SYS]
4284 system-owner-col (collection | unknown) [PWG5100.SYS]
4285   < member attributes are the same as "printer-owner-col" > [PWG5100.SYS]
4286 system-settable-attributes-supported (1setOf keyword) [PWG5100.SYS]
4287 system-strings-languages-supported (1setOf naturalLanguage) [PWG5100.SYS]
4288 system-strings-uri (uri | no-value) [PWG5100.SYS]

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4289 system-xri-supported (1setOf collection) [PWG5100.SYS]
4290 < member attributes are the same as "printer-xri-supported" > [PWG5100.SYS]
4291
4292 System Status attributes: Reference
4293 -----
4294 power-log-col (1setOf collection) [PWG5100.SYS]
4295   log-id (integer(1:MAX)) [PWG5100.SYS]
4296   power-state (type1 keyword) [PWG5100.SYS]
4297   power-state-date-time (dateTime) [PWG5100.SYS]
4298   power-state-message (text(255)) [PWG5100.SYS]
4299 power-state-capabilities-col (1setOf collection) [PWG5100.SYS]
4300   can-accept-jobs (boolean) [PWG5100.SYS]
4301   can-process-jobs (boolean) [PWG5100.SYS]
4302   power-active-watts (integer(0:MAX)) [PWG5100.SYS]
4303   power-inactive-watts (integer(0:MAX)) [PWG5100.SYS]
4304   power-state (type1 keyword) [PWG5100.SYS]
4305 power-state-counters-col (1setOf collection) [PWG5100.SYS]
4306   hibernate-transitions (integer(0:MAX)) [PWG5100.SYS]
4307   on-transitions (integer(0:MAX)) [PWG5100.SYS]
4308   standby-transitions (integer(0:MAX)) [PWG5100.SYS]
4309   suspend-transitions (integer(0:MAX)) [PWG5100.SYS]
4310 power-state-monitor-col (collection) [PWG5100.SYS]
4311   current-month-kwh (integer(0:MAX)) [PWG5100.SYS]
4312   current-watts (integer(0:MAX)) [PWG5100.SYS]
4313   lifetime-kwh (integer(0:MAX)) [PWG5100.SYS]
4314   meters-are-actual (boolean) [PWG5100.SYS]
4315   power-state (type1 keyword) [PWG5100.SYS]
4316   power-state-message (text(255)) [PWG5100.SYS]
4317   power-usage-is-rms-watts (boolean) [PWG5100.SYS]
4318 power-state-transitions-col (1setOf collection) [PWG5100.SYS]
4319   end-power-state (type1 keyword) [PWG5100.SYS]
4320   start-power-state (type1 keyword) [PWG5100.SYS]
4321   state-transition-seconds (integer(0:MAX)) [PWG5100.SYS]
4322 system-config-change-date-time (dateTime) [PWG5100.SYS]
4323 system-config-change-time (integer(0:MAX)) [PWG5100.SYS]
4324 system-config-changes (integer(0:MAX)) [PWG5100.SYS]
4325 system-configured-printers (1setOf collection) [PWG5100.SYS]
4326   printer-id (integer(0:65535)) [PWG5100.SYS]
4327   printer-info (text(127)) [PWG5100.SYS]
4328   printer-is-accepting-jobs (boolean) [PWG5100.SYS]
4329   printer-name (name(127)) [PWG5100.SYS]
4330   printer-service-type (type2 keyword) [PWG5100.SYS]
4331   printer-state (type1 enum) [PWG5100.SYS]
4332   printer-state-reasons (1setOf type2 keyword) [PWG5100.SYS]
4333   printer-xri-supported (collection) [PWG5100.SYS]
4334   < member attributes are the same as "printer-xri-supported" > [PWG5100.SYS]
4335 system-configured-resources (1setOf collection) [PWG5100.SYS]
4336   resource-format (mimeType) [PWG5100.SYS]
4337   resource-id (integer(1:MAX)) [PWG5100.SYS]
4338   resource-info (text(127)) [PWG5100.SYS]
4339   resource-name (name(127)) [PWG5100.SYS]
4340   resource-state (type1 enum) [PWG5100.SYS]
4341   resource-type (type2 keyword) [PWG5100.SYS]
4342 system-impressions-completed (integer(0:MAX)) [PWG5100.SYS]
4343 system-impressions-completed-col (collection) [PWG5100.SYS]
4344   < member attributes are the same as "job-impressions-col" > [PWG5100.SYS]

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4345	system-media-sheets-completed (integer(0:MAX))	[PWG5100.SYS]
4346	system-media-sheets-completed-col (collection)	[PWG5100.SYS]
4347	< member attributes are the same as "job-media-sheets-col" >	[PWG5100.SYS]
4348	system-pages-completed (integer(0:MAX))	[PWG5100.SYS]
4349	system-pages-completed-col (collection)	[PWG5100.SYS]
4350	< member attributes are the same as "job-pages-col" >	[PWG5100.SYS]
4351	system-serial-number (text(255))	[PWG5100.SYS]
4352	system-state (type1 enum)	[PWG5100.SYS]
4353	system-state-change-date-time (dateTime)	[PWG5100.SYS]
4354	system-state-change-time (integer(0:MAX))	[PWG5100.SYS]
4355	system-state-message (text(MAX))	[PWG5100.SYS]
4356	system-state-reasons (1setOf type2 keyword)	[PWG5100.SYS]
4357	system-up-time (integer(1:MAX))	[PWG5100.SYS]
4358	system-uuid (uri(45))	[PWG5100.SYS]
4359	xri-authentication-supported (1setOf type2 keyword)	[PWG5100.SYS]
4360	xri-security-supported (1setOf type2 keyword)	[PWG5100.SYS]
4361	xri-uri-scheme-supported (1setOf uriScheme)	[PWG5100.SYS]
4362		
4363	Job Status attributes:	Reference
4364	-----	-----
4365	job-owner-col (collection unknown)	[PWG5100.SYS]
4366	< member attributes are the same as "printer-owner-col" >	[PWG5100.SYS]
4367	job-resource-ids (1setOf integer(1:MAX))	[PWG5100.SYS]
4368		
4369	Printer Description attributes:	Reference
4370	-----	-----
4371	printer-owner-col (collection unknown)	[PWG5100.SYS]
4372	owner-name (name(MAX))	[PWG5100.SYS]
4373	owner-uri (uri)	[PWG5100.SYS]
4374	owner-vcard (1setOf text(MAX))	[PWG5100.SYS]
4375		
4376	Printer Status attributes:	Reference
4377	-----	-----
4378	printer-config-changes (integer(0:MAX))	[PWG5100.SYS]
4379	printer-id (integer(1:65535))	[PWG5100.SYS]
4380	printer-impressions-completed (integer(0:MAX))	[PWG5100.SYS]
4381	printer-impressions-completed-col (collection)	[PWG5100.SYS]
4382	< member attributes are the same as "job-impressions-col" >	[PWG5100.SYS]
4383	printer-media-sheets-completed (integer(0:MAX))	[PWG5100.SYS]
4384	printer-media-sheets-completed-col (collection)	[PWG5100.SYS]
4385	< member attributes are the same as "job-media-sheets-col" >	[PWG5100.SYS]
4386	printer-pages-completed (integer(0:MAX))	[PWG5100.SYS]
4387	printer-pages-completed-col (collection)	[PWG5100.SYS]
4388	< member attributes are the same as "job-pages-col" >	[PWG5100.SYS]
4389	printer-service-type (type2 keyword)	[PWG5100.SYS]
4390		
4391	Resource Description attributes:	Reference
4392	-----	-----
4393	resource-info (text(MAX))	[PWG5100.SYS]
4394	resource-name (name(MAX))	[PWG5100.SYS]
4395	resource-owner-col (collection unknown)	[PWG5100.SYS]
4396	< member attributes are the same as "printer-owner-col" >	[PWG5100.SYS]
4397		
4398	Resource Status attributes:	Reference
4399	-----	-----
4400	date-time-at-canceled (dateTime no-value)	[PWG5100.SYS]

4401	date-time-at-creation (dateTime)	[PWG5100.SYS]
4402	date-time-at-installed (dateTime no-value)	[PWG5100.SYS]
4403	resource-data-uri (uri no-value)	[PWG5100.SYS]
4404	resource-format (mimeType)	[PWG5100.SYS]
4405	resource-id (integer(1:MAX))	[PWG5100.SYS]
4406	resource-k-octets (integer(0:MAX))	[PWG5100.SYS]
4407	resource-state (type1 enum)	[PWG5100.SYS]
4408	resource-state-message (text(MAX))	[PWG5100.SYS]
4409	resource-state-reasons (1setOf type2 keyword)	[PWG5100.SYS]
4410	resource-string-version (text(127))	[PWG5100.SYS]
4411	resource-type (type2 keyword)	[PWG5100.SYS]
4412	resource-use-count (integer(0:MAX))	[PWG5100.SYS]
4413	resource-uuid (uri(45))	[PWG5100.SYS]
4414	resource-version (octetString(16))	[PWG5100.SYS]
4415	time-at-canceled (integer(MIN:MAX) no-value)	[PWG5100.SYS]
4416	time-at-creation (integer(MIN:MAX))	[PWG5100.SYS]
4417	time-at-installed (integer(MIN:MAX) no-value)	[PWG5100.SYS]

4418 13.3 Type2 keyword Attribute Value Registrations

4419 The keyword attribute values defined in this document will be published by IANA according
 4420 to the procedures in the IPP Model and Semantics [RFC8011] section 7.3 in the following
 4421 file:

4422 <http://www.iana.org/assignments/ipp-registrations>

4423 The registry entries will contain the following information:

4424	Attributes (attribute syntax)	
4425	Keyword Attribute Value	Reference
4426	-----	-----
4427	end-power-state (type1 keyword)	[PWG5100.SYS]
4428	< any "power-state" value >	[PWG5100.SYS]
4429		
4430	notify-events (1setOf type2 keyword)	[RFC3995]
4431	printer-created	[PWG5100.SYS]
4432	printer-deleted	[PWG5100.SYS]
4433	resource-canceled	[PWG5100.SYS]
4434	resource-config-changed	[PWG5100.SYS]
4435	resource-created	[PWG5100.SYS]
4436	resource-installed	[PWG5100.SYS]
4437	resource-state-changed	[PWG5100.SYS]
4438	system-config-changed	[PWG5100.SYS]
4439	system-restarted	[PWG5100.SYS]
4440	system-shutdown	[PWG5100.SYS]
4441	system-state-changed	[PWG5100.SYS]
4442	system-stopped	[PWG5100.SYS]
4443		
4444	power-state (type1 keyword)	[PWG5100.SYS]
4445	hibernate	[PWG5100.SYS]
4446	hibernate-vendor1	[PWG5100.SYS]
4447	hibernate-vendor2	[PWG5100.SYS]
4448	hibernate-vendor3	[PWG5100.SYS]
4449	hibernate-vendor4	[PWG5100.SYS]

4450	hibernate-vendor5	[PWG5100.SYS]
4451	off-hard	[PWG5100.SYS]
4452	off-hard-graceful	[PWG5100.SYS]
4453	off-soft	[PWG5100.SYS]
4454	off-soft-graceful	[PWG5100.SYS]
4455	off-soft-vendor1	[PWG5100.SYS]
4456	off-soft-vendor2	[PWG5100.SYS]
4457	off-soft-vendor3	[PWG5100.SYS]
4458	off-soft-vendor4	[PWG5100.SYS]
4459	off-soft-vendor5	[PWG5100.SYS]
4460	on	[PWG5100.SYS]
4461	on-vendor1	[PWG5100.SYS]
4462	on-vendor2	[PWG5100.SYS]
4463	on-vendor3	[PWG5100.SYS]
4464	on-vendor4	[PWG5100.SYS]
4465	on-vendor5	[PWG5100.SYS]
4466	reset-hard	[PWG5100.SYS]
4467	reset-hard-graceful	[PWG5100.SYS]
4468	reset-init	[PWG5100.SYS]
4469	reset-mbr	[PWG5100.SYS]
4470	reset-mbr-graceful	[PWG5100.SYS]
4471	reset-nmi	[PWG5100.SYS]
4472	reset-soft	[PWG5100.SYS]
4473	reset-soft-graceful	[PWG5100.SYS]
4474	standby	[PWG5100.SYS]
4475	standby-vendor1	[PWG5100.SYS]
4476	standby-vendor2	[PWG5100.SYS]
4477	standby-vendor3	[PWG5100.SYS]
4478	standby-vendor4	[PWG5100.SYS]
4479	standby-vendor5	[PWG5100.SYS]
4480	suspend	[PWG5100.SYS]
4481	suspend-vendor1	[PWG5100.SYS]
4482	suspend-vendor2	[PWG5100.SYS]
4483	suspend-vendor3	[PWG5100.SYS]
4484	suspend-vendor4	[PWG5100.SYS]
4485	suspend-vendor5	[PWG5100.SYS]
4486		
4487	printer-service-type (type2 keyword)	[PWG5100.SYS]
4488	copy	[PWG5100.SYS]
4489	faxin	[PWG5100.SYS]
4490	faxout	[PWG5100.SYS]
4491	print	[PWG5100.SYS]
4492	print3d	[PWG5100.SYS]
4493	scan	[PWG5100.SYS]
4494	transform	[PWG5100.SYS]
4495		
4496	printer-state-reasons (1setOf type2 keyword)	[RFC8011]
4497	deleted	[PWG5100.SYS]
4498	resuming	[PWG5100.SYS]
4499		
4500	request-power-state (type1 keyword)	[PWG5100.SYS]
4501	< any "power-state" value >	[PWG5100.SYS]
4502		
4503	requested-attributes (1setOf type2 keyword)	[RFC8011]
4504	resource-description	[PWG5100.SYS]
4505	resource-status	[PWG5100.SYS]

4506	resource-template	[PWG5100.SYS]
4507	system-description	[PWG5100.SYS]
4508	system-status	[PWG5100.SYS]
4509		
4510	resource-state-reasons (1setOf type2 keyword)	[PWG5100.SYS]
4511	< any "job-state-reasons" value >	[PWG5100.SYS]
4512	cancel-requested	[PWG5100.SYS]
4513	install-requested	[PWG5100.SYS]
4514	resource-incoming	[PWG5100.SYS]
4515		
4516	resource-type (type2 keyword)	[PWG5100.SYS]
4517	executable-firmware	[PWG5100.SYS]
4518	executable-software	[PWG5100.SYS]
4519	static-font	[PWG5100.SYS]
4520	static-form	[PWG5100.SYS]
4521	static-icc-profile	[PWG5100.SYS]
4522	static-image	[PWG5100.SYS]
4523	static-logo	[PWG5100.SYS]
4524	static-other	[PWG5100.SYS]
4525	static-strings	[PWG5100.SYS]
4526	template-document	[PWG5100.SYS]
4527	template-job	[PWG5100.SYS]
4528	template-printer	[PWG5100.SYS]
4529		
4530	start-power-state (type1 keyword)	[PWG5100.SYS]
4531	< any "power-state" value >	[PWG5100.SYS]
4532		
4533	system-state-reasons (1setOf type2 keyword)	[PWG5100.SYS]
4534	< any "printer-state-reasons" value >	[PWG5100.SYS]
4535		
4536	timeout-predicate (type1 keyword)	[PWG5100.SYS]
4537	activity	[PWG5100.SYS]
4538	inactivity	[PWG5100.SYS]
4539	none	[PWG5100.SYS]
4540		
4541	which-printers (type2 keyword)	[PWG5100.SYS]
4542	all	[PWG5100.SYS]
4543	idle	[PWG5100.SYS]
4544	not-accepting	[PWG5100.SYS]
4545	processing	[PWG5100.SYS]
4546	shutdown	[PWG5100.SYS]
4547	stopped	[PWG5100.SYS]
4548	testing	[PWG5100.SYS]

4549 13.4 Type2 enum Attribute Value Registrations

4550 The enumerations defined in this document will be published by IANA according to the
 4551 procedures in the IPP Model and Semantics [RFC8011] section 7.4 in the following file:

4552 <http://www.iana.org/assignments/ipp-registrations>

4553 The registry entries will contain the following information:

4554 Attributes (attribute syntax)

4555	Enum Value	Enum Symbolic Name	Reference
4556	-----	-----	-----
4557	operations-supported (1setOf type2 enum)		[RFC8011]
4558	0x001E	Get-Resource-Attributes	[PWG5100.SYS]
4559	0x0020	Get-Resources	[PWG5100.SYS]
4560	0x004B	Allocate-Printer-Resources	[PWG5100.SYS]
4561	0x004C	Create-Printer	[PWG5100.SYS]
4562	0x004D	Deallocate-Printer-Resources	[PWG5100.SYS]
4563	0x004E	Delete-Printer	[PWG5100.SYS]
4564	0x004F	Get-Printers	[PWG5100.SYS]
4565	0x0050	Shutdown-One-Printer	[PWG5100.SYS]
4566	0x0051	Startup-One-Printer	[PWG5100.SYS]
4567	0x0052	Cancel-Resource	[PWG5100.SYS]
4568	0x0053	Create-Resource	[PWG5100.SYS]
4569	0x0054	Install-Resource	[PWG5100.SYS]
4570	0x0055	Send-Resource-Data	[PWG5100.SYS]
4571	0x0056	Set-Resource-Attributes	[PWG5100.SYS]
4572	0x0057	Create-Resource-Subscriptions	[PWG5100.SYS]
4573	0x0058	Create-System-Subscriptions	[PWG5100.SYS]
4574	0x0059	Disable-All-Printers	[PWG5100.SYS]
4575	0x005A	Enable-All-Printers	[PWG5100.SYS]
4576	0x005B	Get-System-Attributes	[PWG5100.SYS]
4577	0x005C	Get-System-Supported-Values	[PWG5100.SYS]
4578	0x005D	Pause-All-Printers	[PWG5100.SYS]
4579	0x005E	Pause-All-Printers-After-Current-Job	[PWG5100.SYS]
4580	0x005F	Register-Output-Device	[PWG5100.SYS]
4581	0x0060	Restart-System	[PWG5100.SYS]
4582	0x0061	Resume-All-Printers	[PWG5100.SYS]
4583	0x0062	Set-System-Attributes	[PWG5100.SYS]
4584	0x0063	Shutdown-All-Printers	[PWG5100.SYS]
4585	0x0064	Startup-All-Printers	[PWG5100.SYS]
4586	0x0065	Get-Printer-Resources	[PWG5100.SYS]
4587			
4588	resource-state (type1 enum)		[PWG5100.SYS]
4589	3	pending	[PWG5100.SYS]
4590	4	available	[PWG5100.SYS]
4591	5	installed	[PWG5100.SYS]
4592	6	canceled	[PWG5100.SYS]
4593	7	aborted	[PWG5100.SYS]
4594			
4595	system-state (type1 enum)		[PWG5100.SYS]
4596	3	idle	[PWG5100.SYS]
4597	4	processing	[PWG5100.SYS]
4598	5	stopped	[PWG5100.SYS]

4599 13.5 Attribute Group Registrations

4600 The attribute groups defined in this document will be published by IANA according to the
 4601 procedures in the IPP Model and Semantics [RFC8011] section 7.5 in the following file:

4602 <http://www.iana.org/assignments/ipp-registrations>

4603 The registry entries will contain the following information:

4604	Attribute Group Value	Symbolic Name	Reference
4605	-----	-----	-----
4606	0x08	resource-attributes-tag	[PWG5100.SYS]
4607	0x0A	system-attributes-tag	[PWG5100.SYS]

4608 13.6 Operation Registrations

4609 The operations defined in this document will be published by IANA according to the
 4610 procedures in the IPP Model and Semantics [RFC8011] section 7.8 in the following file:

4611 <http://www.iana.org/assignments/ipp-registrations>

4612 The registry entries will contain the following information:

4613	Operation Name	Reference
4614	-----	-----
4615	Allocate-Printer-Resources	[PWG5100.SYS]
4616	Cancel-Resource	[PWG5100.SYS]
4617	Cancel-Subscription (extension)	[PWG5100.SYS]
4618	Create-Job (extension)	
4619	Create-Printer	[PWG5100.SYS]
4620	Create-Resource	[PWG5100.SYS]
4621	Create-Resource-Subscriptions	[PWG5100.SYS]
4622	Create-System-Subscriptions	[PWG5100.SYS]
4623	Deallocate-Printer-Resources	[PWG5100.SYS]
4624	Delete-Printer	[PWG5100.SYS]
4625	Disable-All-Printers	[PWG5100.SYS]
4626	Enable-All-Printers	[PWG5100.SYS]
4627	Get-Notifications (extension)	[PWG5100.SYS]
4628	Get-Printer-Attributes (extension)	[PWG5100.SYS]
4629	Get-Printer-Resources	[PWG5100.SYS]
4630	Get-Printers	[PWG5100.SYS]
4631	Get-Resource-Attributes	[PWG5100.SYS]
4632	Get-Resources	[PWG5100.SYS]
4633	Get-Subscription-Attributes (extension)	[PWG5100.SYS]
4634	Get-Subscriptions (extension)	[PWG5100.SYS]
4635	Get-System-Attributes	[PWG5100.SYS]
4636	Get-System-Supported-Values	[PWG5100.SYS]
4637	Install-Resource	[PWG5100.SYS]
4638	Pause-All-Printers	[PWG5100.SYS]
4639	Pause-All-Printers-After-Current-Job	[PWG5100.SYS]
4640	Print-Job (extension)	[PWG5100.SYS]
4641	Print-URI (extension)	[PWG5100.SYS]
4642	Register-Output-Device	[PWG5100.SYS]
4643	Restart-System	[PWG5100.SYS]
4644	Renew-Subscription (extension)	[PWG5100.SYS]
4645	Resume-All-Printers	[PWG5100.SYS]
4646	Send-Resource-Data	[PWG5100.SYS]
4647	Set-Resource-Attributes	[PWG5100.SYS]
4648	Set-System-Attributes	[PWG5100.SYS]
4649	Shutdown-All-Printers	[PWG5100.SYS]
4650	Shutdown-One-Printer	[PWG5100.SYS]
4651	Startup-All-Printers	[PWG5100.SYS]
4652	Startup-One-Printer	[PWG5100.SYS]

14. References

14.1 Normative References

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16. Appendix A – Rationale for Design Choices

This section describes the rationale for important design choices made in the development of this IPP System Service specification.

16.1 Resource Object

16.1.1 Move Resource Service operations into System Service

The PWG Network Resource Service [PWG5108.03] was unique because it wasn't a Job service and was implicitly a capability of the overall System. Therefore, selected Resource operations have been incorporated into the System Service.

16.1.2 Remove some Resource operations

The PWG Network Resource Service [PWG5108.03] defined a DeleteResource operation that was incompatible with System log files and audit trail mechanisms. Instead a new Cancel-Resource operation has been added to the System Service that permanently removes the Resource from further use but preserves the Resource metadata in a Resource History phase for correlation with System log files.

The PWG Network Resource Service [PWG5108.03] defined a RetrieveResource operation for reading the contents of the Resource data that was inherently insecure. This operation has been removed from the System Service.

The PWG Network Resource Service [PWG5108.03] defined a ReplaceResource operation for replacing the contents of the Resource data that was inherently insecure. This operation has been removed from the System Service.

The PWG Network Resource Service [PWG5108.03] defined a RenewResource operation for renewing the lease on a Resource. This operation has been removed from the System Service.

The PWG Network Resource Service [PWG5108.03] defined a set of Administrative service-level operations (DisableResourceService, EnableResourceService, RestartResourceService, ShutdownResourceService, and StartupResourceService). These operations have been removed from the System Service.

16.1.3 Decompose some Resource operations

The PWG Network Resource Service [PWG5108.03] defined a single operation StoreResource that both created the Resource metadata object and uploaded the Resource data, by analogy to the Print-Job operation defined in [RFC8011]. Consistent with current PWG design philosophy, this StoreResource operation has been decomposed into Create-Resource (create Resource object), Send-Resource-Data (upload Resource data), and Install-Resource (install executable, static, or template Resource for use). Installation of an executable Resource (e.g., firmware) can involve a System or Subunit reboot to complete.

4904 **16.1.4 Replace Resource lease with Resource state**

4905 The PWG Network Resource Service [PWG5108.03] used the lease concept from the
4906 Subscription object defined in [RFC3995]. There was a strong consensus to move away
4907 from leases and instead add a new “resource-state” Resource Status attribute for clarity and
4908 flexibility.

4909 **16.2 Printer Object**

4910 **16.2.1 Restrict “printer-id” range**

4911 For compatibility with IETF Printer MIB v2 [RFC3805] and existing discovery protocols the
4912 maximum value of “printer-id” and members of “printer-ids” is restricted to 65535 (16-bit
4913 unsigned maximum value). Although some IPP implementations might support more than
4914 65535 print queues, this 16-bit restriction was deemed important for best compatibility with
4915 SNMP, Bluetooth, and other interfaces. Implementations needing more than 65535 print
4916 queues can use “printer-uuid” and/or partitioning of “printer-id” number spaces.

17. Change History

17.1 May 4, 2018

- Added missing xri-xxx-supported System Status attributes
- Added missing work totals (formerly system-totals) for both System and Printer Status (xxx-impressions-completed[-col], xxx-media-sheets-completed[-col], and xxx-pages-completed[-col])
- Added "multiple-document-printers-supported" and "printer-service-type-supported" System Description attributes
- Eliminated the extra Job Status Attributes section (7.9)
- resource-name and resource-info are now "name(MAX)" and "text(MAX)" respectively
- resource-owner-col is now collection | unknown
- DISCUSS for resource-string-version and resource-version size limits
- DISCUSS making all type1 keyword attributes type1 enum since they are ordered, non-extensible lists?
- owner-user-name should have been owner-name
- Updated the IANA considerations

17.2 May 2, 2018

- Create-Printer, "printer-creation-attributes-supported", "system-mandatory-printer-attributes": Clarified interactions.
- Added "printer-xri-requested" operation attribute
- Added "document-format-supported" System Description attribute

17.3 April 25, 2018

- Abstract: Simplified.
- Fixed a bunch of broken references, other typos.
- Added editor's notes based on prototyping experience.
- "system-configured-printers" and "system-configured-resources": allow no-value.
- Added missing "ippget-event-life" and "notify-xxx" System Description attributes.
- Added missing "notify-system-uri" and "notify-system-up-time" Subscription Status attributes.
- Some "date-time-at-xxx" and "time-at-xxx" Resource Status attributes need to include 'no-value' syntax.
- Added 'static-strings' and 'static-other' "resource-type" values, renamed 'static-iccprofile' to 'static-icc-profile'.
- Added discussion for "xxx-owner-col" attributes, "collection | unknown".

17.4 14 February 2018

- Fixed operation name in section 6.3.4.x.
- Section 6.2.3: Added list of requested-attributes values.
- Section 6.2.5: Moved the specifics of signature validation to section 12.5, added reference.
- Section 6.3.4.2: Added system state attributes to the response.
- Section 6.3.7: Added list of requested-attributes values.
- Section 6.3.8: Added list of requested-attributes values.
- Section 6.3.9: Added list of requested-attributes values.
- Section 6.3.13: Added missing close quote and fixed Figure 1 (was fuzzy).
- New Section 9.3: Additional values for "requested-attributes"
- Section 12: Filled out the security considerations for resources.
- Section 13.3: Added requested-attributes values.

17.5 12 January 2018

- Section 6.3.x: Added Delete-Printer operation
- Section 6.3.12: Added note about next steps, updated Figure 1, added reference to software rejuvenation paper
- Sections 8.1 and 8.3: Reword "system-uri" attribute as specifying the target System object.
- Section 14.2: Added reference to software rejuvenation paper

17.6 17 November 2017

- Updated document styles and boilerplate text from current WD template.
- Moved Create-Printer, Create-Resource, Create-System-Subscriptions, and Get-Resources operations to section 6.4 (System Operations) since the target is a System object.
- Moved Create-Resource-Subscriptions operation to section 6.2 (Resource Operations) since the target is a Resource object.
- Deleted section 6.3 (Subscription Operations) since there were no more operations in this section.
- Added Restart-System flow chart (figure)
- Added missing "job-resource-ids" operation and Job Status attribute definitions.
- Reworked section 8 (Additional Semantics) with the brief summary format used in other recent IPP specifications.
- Added "notify-events" and "printer-state-reasons" keywords.

17.7 13 November 2017

- Prototype draft – changes per IPP WG review on 9 November 2017
- global – accepted all changes from previous draft

4988 - global – added comments to all Create-Xxx operations to possibly move to section 6.4
4989 System Operations
4990 - revised section 2.4 Abbreviations to add “DPA” with link
4991 - revised section 5.4 System Operations to capitalize Systems, add DPA reference
4992 [ISO10175-3], and correct typos
4993 - revised section 6 IPP Operations to delete “of the originating Operator or Administrator”
4994 - revised section 6.1.6 Get-Printer-Resources to insert missing “the” in “return “resource-id”
4995 for each”
4996 - revised section 6.1.6.1 Get-Printer-Resources Request to change “system-uri” to “printer-
4997 uri”
4998 - revised section 6.2.3 Get-Resources to insert missing “the” in “return “resource-id” for each”
4999 - revised section 6.4 System Operations to insert missing leading quote before printer-
5000 message-from-operator”
5001 - revised section 8.1 Cancel-Subscription, Get-Notifications, and Renew-Subscription and
5002 section 8.3 Create-Job, Get-Job-Attributes to add comments about minimal extension format
5003 for existing operations
5004 - revised section 8.2 Get-Printer-Attributes to change ‘successful-ok’ to ‘client-error-not-
5005 found and add comment about minimal extension format for existing operations
5006