A Project of the PWG-IPP Working Group

Printer Working Group (PWG): Semantic Model

IEEE-ISTO Printer Working Group Standard XXXX.X-200X

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Abstract

This document is a high level overview of the Semantic Model defined by the PWG. This document briefly describes the semantic elements defined in various PWG documents and PWG documents submitted to the IETF. The Semantic Model also incorporates additions made by other groups addressing print systems. With every semantic element included a reference is provided to the document and section that details the semantic definition.

The Semantic Model contains a high level description of the Actions that operate on the objects and attributes in the model. This document does not describe the mapping of the semantics onto a specific protocol or network environment.

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1 Introduction

This document is a high level overview of the Semantic Model defined by the PWG. This document briefly describes the semantic elements defined in various PWG documents and PWG documents submitted to the IETF. The Semantic Model also incorporates additions made by other groups addressing print systems. With every semantic element included a reference is provided to the document and section that details the semantic definition.

The Semantic Model contains a high level description of the Actions that operate on the objects and Elements in the model. This document does not describe the mapping of the semantics onto a specific protocol or network environment.

2 Terminology

Action	A request that a Print Client makes to an object to perform some activity. The object returns a response to the Print Client that contains some information about the effect of the action on the object.
Data Class	A template for data describing an object and representing its state. Each Element in the data class represents a semantic element of the associated object.
Document	An object containing descriptive and state information for a logical unit of information to be printed. The object may contain processing information. The document content is represented by a single data (e.g. PDL, image) file and contains Pages.
Document Processing Elements	Document Elements supplied by the Print Client to direct the printing of a Document that the Printer copies to the Document. Examples: Copies, Finishings, Media, NumberUp.
End User	A print client that has no special rights on the printer. The End User typically submits jobs. The End User is allowed to query the printer, jobs and documents and control jobs based on policy.
Impression	Everything printed on a single side of a media
Job	An object that represents the submission of work for the printer. It contains descriptive and state information as well as default Document Processing Elements. Jobs contain one or more Documents
Job Description Elements	Job Elements supplied by the Print Client to describe the Job. Examples: JobName, RequestingUserName, JobRecipient
Job Processing Elements	Job Elements supplied by the Print Client to direct the printing of the Job as a whole that the Printer copies to the Job. Examples: JobHoldUntil, JobPriority, JobCopies, JobFinishings.
Object	A entity that instantiates a data class and implements the appropriate actions.
Operator	A print client that has special rights on the printer. The Operator typically oversees the printer. The Operator is allowed to query and control the printer, jobs and documents based on site policy.
MediaSheet	A sheet of paper, or other material, used for printing
Page	A logical entity that represents the information contained on a single side of a sheet of media. Note that this is the electronic form and that multiple pages can be rendered into a single impression through N-Up printing
PDL	(Page Description Language) A language that describes the content to be printed and how it will be laid out on a page (e.g. Adobe PostScript®, Hewlett Packard PCL®).
Print Client	An application or network entity that performs actions

Printer	An object that represents a printing device, set of printing devices, or a printing service and contains zero or more Jobs
Type 1 keyword	All the values are defined in the specification. Additional values require a new specification.
Type 2 keyword	An initial set of values is defined in the specification. This working group registers additional values after review. The initial versions of the specification will contain the values registered so far. After the specification is approved, this working group will register additional values after approval.
Type 3 keyword	An initial set of values is defined in the specification. Additional values are registered without working group review. The initial versions of the specification contain the values registered so far. After the specification is approved, this working group will register additional values without approval.

3 Model Overview

The Printer Working Group (PWG) has defined a simplified printing model. It represents printing in either a client/server print paradigm or a peer-to-peer print paradigm. The PWG model describes the device as a Printer object. A Printer object may represent one or more physical Printers. Another object is the Job. A Printer can contain zero or more Jobs and a Job is contained in only one Printer. Each Job can contain zero or more documents. A Job can contain zero or more Documents and a Document is contained in only one Printer. The PWG model contains methods that act upon these objects.

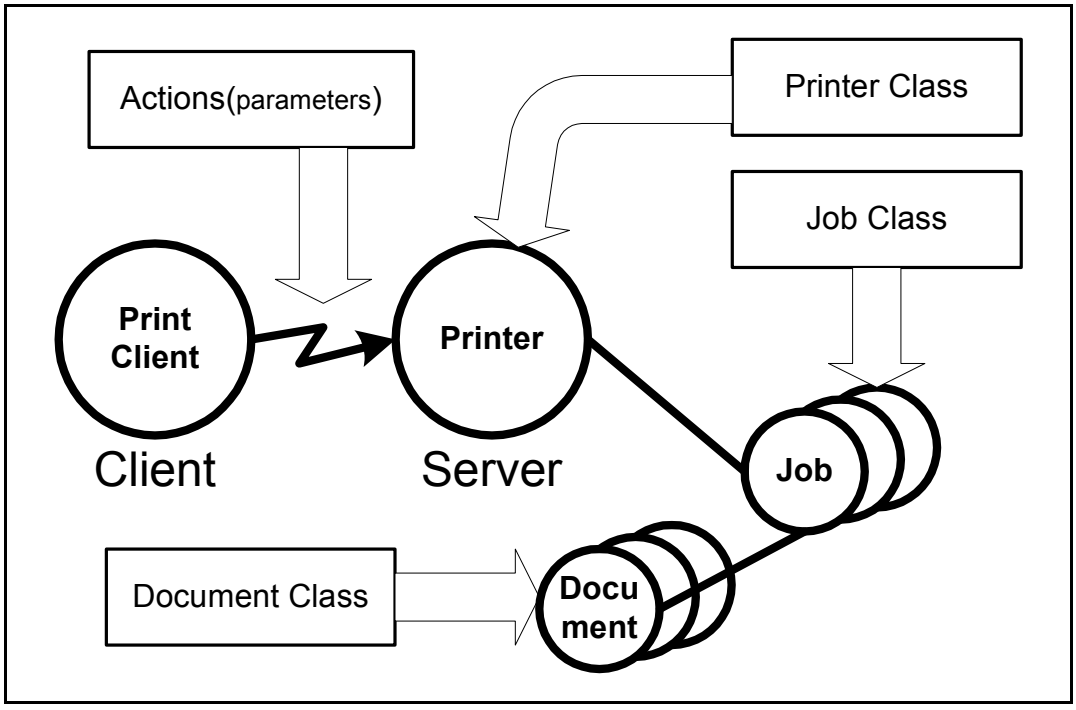


Figure 1 Model Overview

The objects are represented in the semantic model as data classes. The methods are represented as a set of actions that act upon those data classes. The actions permit the creation and control of Jobs and documents as well as the submission of Document data. The content of a Document is

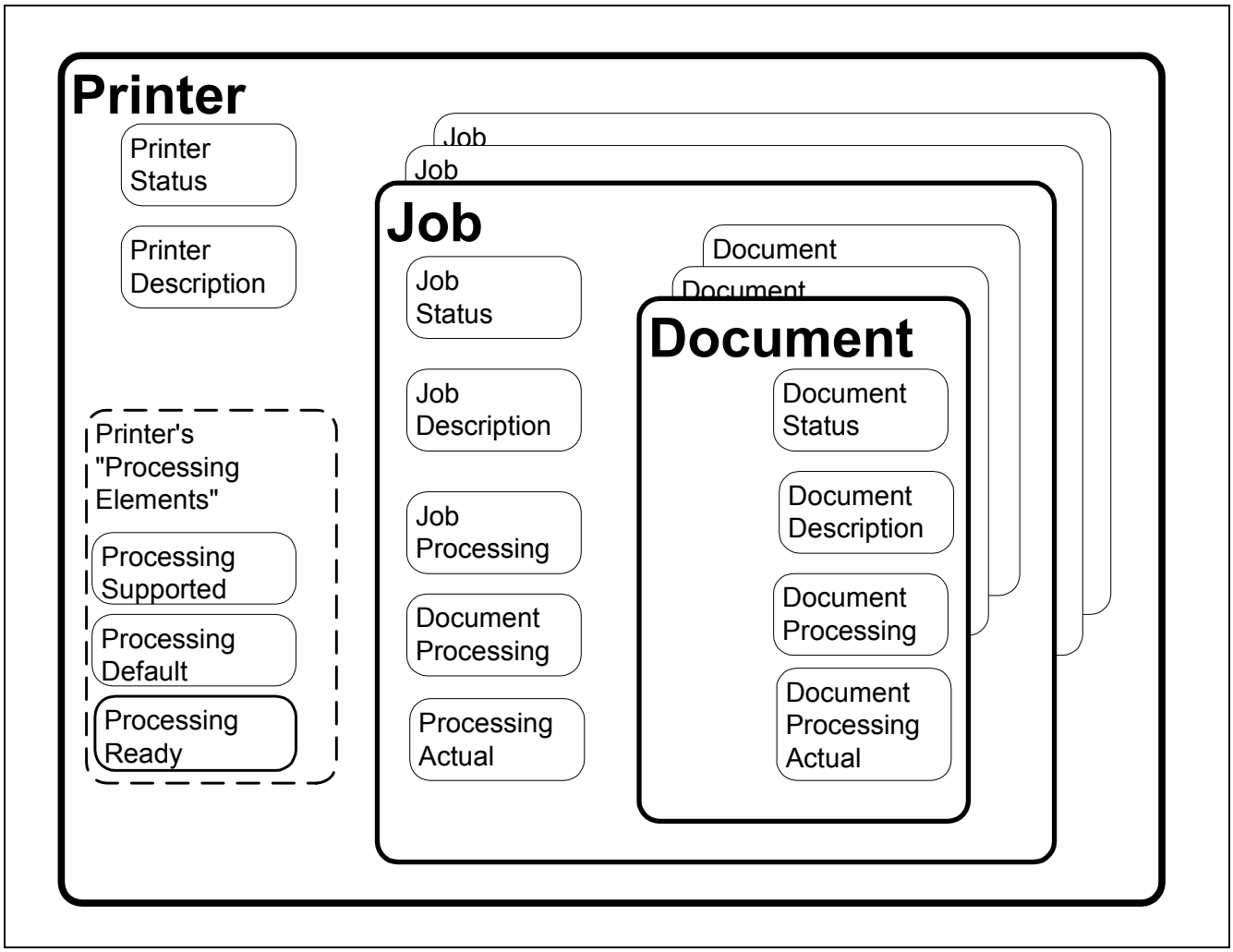
187 included in the submission or can be accessed via a URL reference. There are also actions to query
188 a Printer, Job or Document to access their Elements or to list their contained objects.

189 The model uses a number of terms with specific meaning for a printer.

190 4 Data Classes

191 This section describes the data classes in the PWG semantic model. Some of the classes are taken
192 from the model and semantics of IPP [rfc2911].

193 Figure 2 Shows the data classes, their elements and the containment relationship between the
194 classes



195
196

197 Figure 2 Data Classes

198 *4.1 Printer Object Class*

199 The Printer class is represented by a collection of elements as shown in

Figure 2. The Printer Elements are presented in detail in Table 6. The printer object also contains elements that describe the valid processing element values. (See section 4.4 for processing elements) The Printer class is the container for Jobs.

4.1.1 Printer Status Elements

Figure 3 below shows the Printer Status Elements. These elements represent the state of the printer such as the number of jobs or existing error conditions. Automata change the values of the elements in this group. End Users cannot directly modify their values. The End User can affect the values of these elements through actions (e.g. PausePrinter can change the value of PrinterIsAcceptingJobs"). The semantics of the elements are summarized in Table 6.

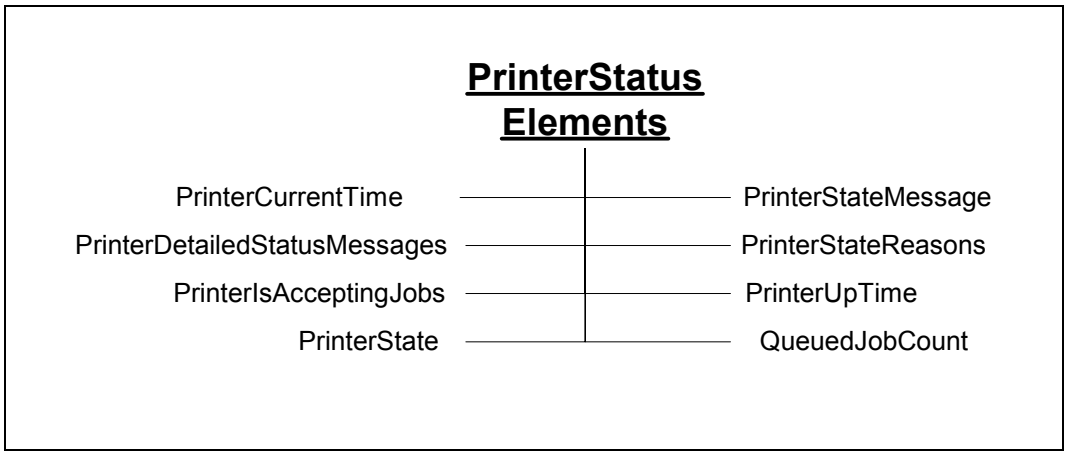


Figure 3 Printer Status Elements

The "PrinterState" element is one of the most important Printer Status elements. Figure 4 shows the values of the "PrinterState" element and the Printer life cycle as affected by actions on the Printer and job processing.

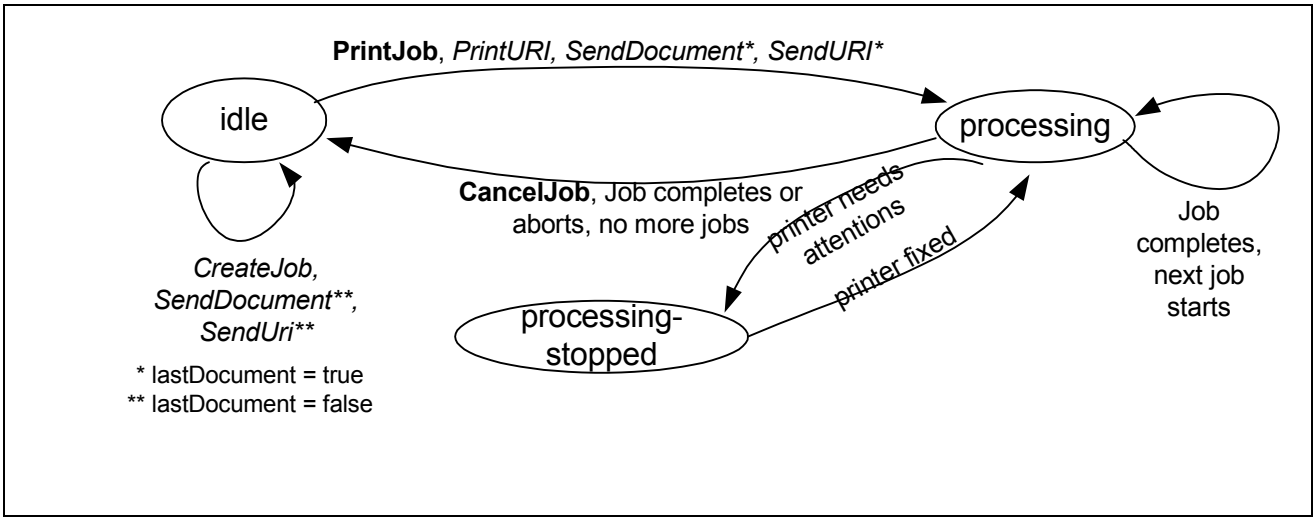


Figure 4 - The "PrinterState" element and the Printer Life Cycle

4.1.2 Printer Description Elements

Figure 5 below shows the Printer Description Elements. These elements contain information that describes the printer such as its make, where it's located and its speed. An automaton controls some of the elements in this group (e.g. "PagesPerMinute"). Others elements in this group can be modified by Operators or Administrators (e.g. "PrinterName"). The semantics of the elements are summarized in Table 6.

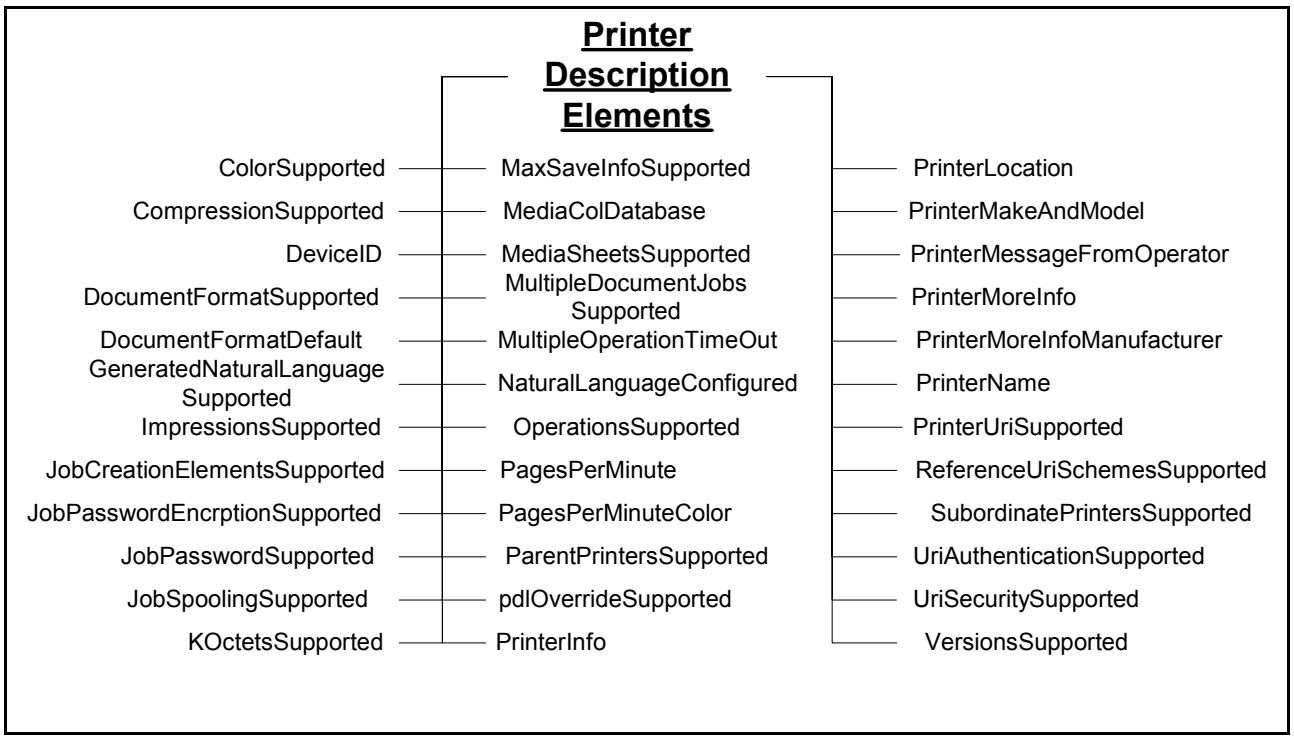


Figure 5 Printer Description Elements

4.1.3 Printer Defaults, Supported and Ready Processing Elements

See section 4.4 below for the elements that may comprise these groups. Processing Elements are the union of Job Processing Elements and Document Processing Elements. If a Processing element (e.g. Media) is supported, the Printer must have an associated Processing Supported Element (e.g. MediaSupported) and Processing Default Element (e.g. MediaDefault) Printer element. There may be an associated Processing Ready Element (e.g. MediaReady) Printer element. By retrieving the Printer Processing elements, a Client can determine all the Job and Document Processing elements and values that may be used in creating Jobs and Documents.

4.1.3.1 Processing Supported Elements

These elements list all the currently configured valid values for each Job Processing Element and Document Processing Element. Though the Printer is configured to support the feature, human intervention may be required to process the job (e.g. selected paper may have to be loaded into a tray). The syntax for Processing Elements Supported is multi-valued when the associated

processing element is a string. When syntax of the processing element is an integer, the syntax of the corresponding Processing Supported Element is usually RangeOfInteger that indicates the minimum and maximum values supported by the Printer. However, there are some exceptions as indicated in Table 1.

Table 1-Integer syntax whose ProcessingElementSupported syntax isn't RangeOfInteger

"xxx" element name	"xxx" syntax	"xxxSupported" syntax
JobPriority	Integer	Integer (Max value)
Copies	Integer	Integer (Max value)
PageRanges	RangeOfInteger (Multivalued)	Boolean (are PageRanges supported)

4.1.3.2 Processing Default Elements

These elements give the default value for the associated processing instruction if the Processing Element of the job and document are not supplied and the instructions is not embedded in the PDL. The syntax for the Processing Default Elements is the same as the corresponding Processing Element. The only exception is that the PageRanges element does not have a PageRangesDefault element.

4.1.3.3 Processing Ready Elements

These elements give the features available without human intervention. The syntax for a Processing Ready Element is the same as the corresponding Processing Element.

4.2 Job Object Class

The Job object class is represented by a collection of elements divided into four groups as shown in Figure 2. The Job class also contains the document class

- Job Status Elements – See Section 4.2.1
- Job Description Elements – See section 4.2.2.
- Job Processing Elements – See section 4.4.1
- Document Processing Elements – See section 4.4.2

4.2.1 Job Status Elements

Figure 6 below shows the Job Status Elements. Automata primarily control the elements in this group. End Users cannot directly modify their values. The End User can affect the values of these elements through actions (e.g. CancelJob can change the value of JobStateReasons"). The semantics of the elements are summarized in Table 4.

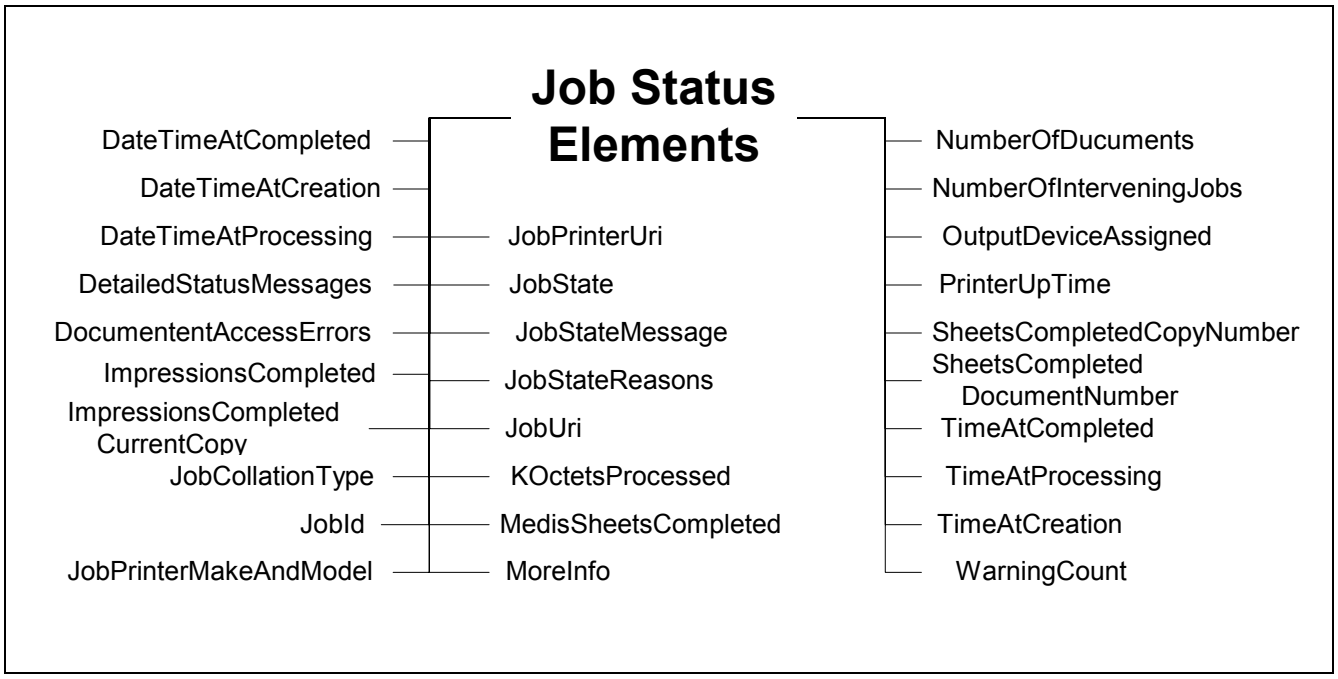


Figure 6 Job Status Elements

4.2.1.1 The Job Life Cycle

The "JobState" element is one of the most important Job Status elements. Figure 7 shows the values of the "JobState" element and the Job life cycle as affected by actions on the Job, Printer, and job processing.

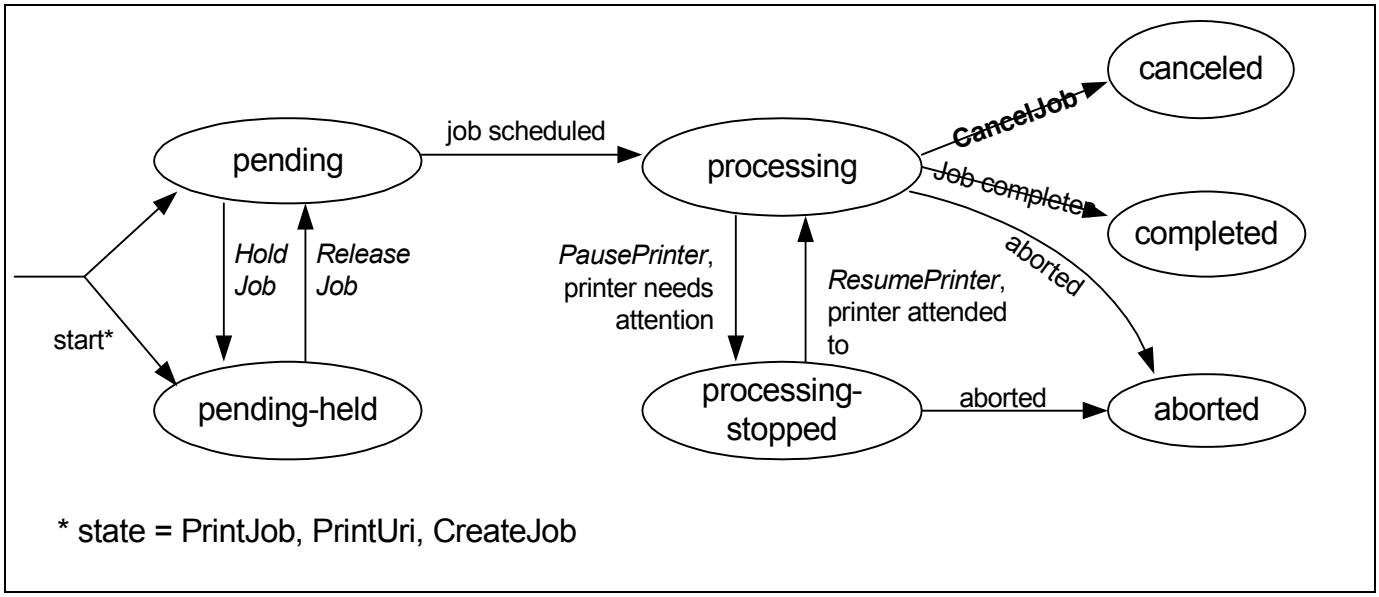


Figure 7 The "JobState" Job Element and the Job object life cycle

4.2.2 Job Description Elements

Figure 8 below shows the Job Elements. These elements contain information from the End User at Job creation that describes the Job such as its name. Automaton may modify the value of some of the elements in this group (e.g. "KOctets") if more reliable data is obtained. The semantics of the elements are summarized in Table 4.

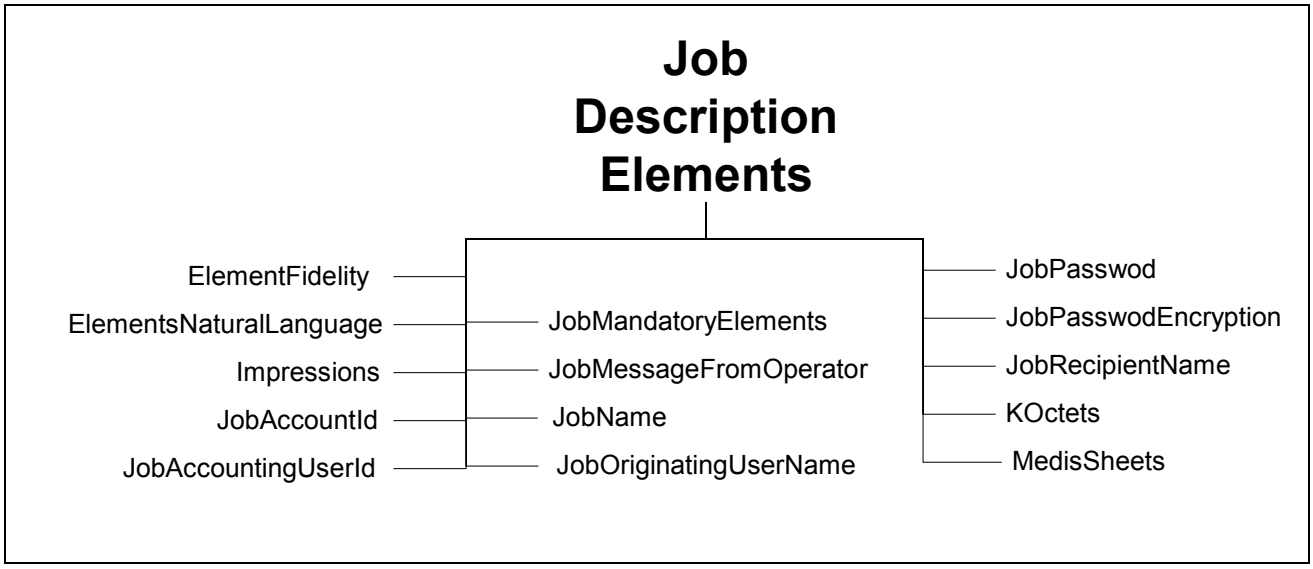


Figure 8 Job Description Elements

4.2.3 Processing Actual Element

See section 4.4 below for the elements that may map to elements in this groups. The ProcessingActual element is an optional Job element that records what processing elements were used in a Job and its Documents. The mapping between the Processing element and the ProcessingActual element is by taking the Processing element name and appending the suffix "Actual". The ProcessingActual is always multivalued.

Any Processing element may have a related ProcessingActual element that shows what was applied to the Job. It is not necessary for the Printer to support the Processing element for it to support the associated ProcessingActual element. By retrieving the Printer ProcessingActual elements after a job completes, a Client can determine all the Job and Document Processing elements and values that were used in processing the Job and its Documents. (See [actual])

4.3 Document Object Class

The Document object class is represented by a collection of elements divided into three groups as shown in

Figure 2. The Document class contains the document class

Document Status Elements – See Section 4.3.1.
Document Description Elements – See section 4.3.2.
Document Processing Elements – See section 4.4.2

4.3.1 Document Status Elements

Figure 9 shows the Document Status Elements. Automata primarily control the elements in this group. End Users cannot directly modify their values. The End User can affect the values of these elements through actions (e.g. CancelDocument can change the value of DocumentState"). The semantics of the elements are summarized Table 5

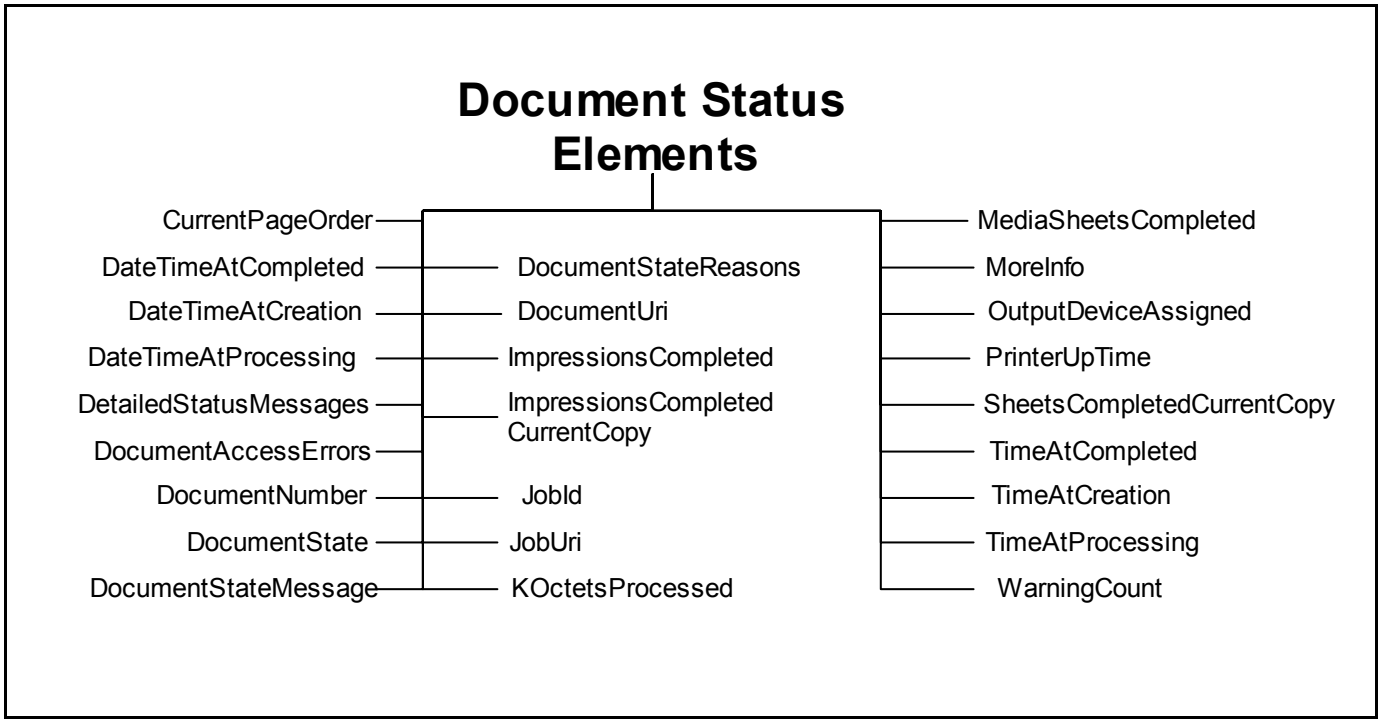


Figure 9 Document Status Elements

4.3.1.1 The Document Life Cycle

The "DocumentState" element is one of the most important Document Status Elements. Figure 10 shows the values of the "DocumentState" element and the Document life cycle as affected by Actions and job processing. Documents are not active objects and their life cycle is closely tied to the lifecycle of a Job. Documents basically have three states. The first is waiting to be processed by a Job (i.e., pending). The second state is from the time the Job first starts processing the Document (i.e., processing) and until it reaches its terminating state. The last state for a Document is its terminal state (i.e., completed, canceled, aborted)

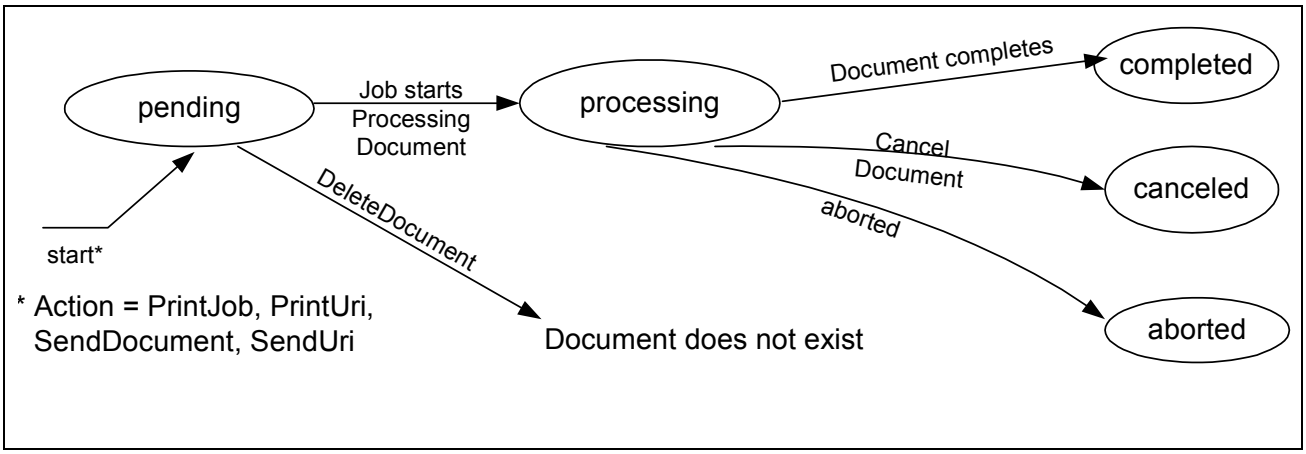


Figure 10 "DocumentState" Element and Document object life Cycle

4.3.2 Document Description Elements

Figure 11 shows the Document Description Elements. These elements contain information from the End User at Document creation that describes the document such as its size. Automaton may modify the value of some of the elements in this group (e.g. "KOctets") if more reliable data is obtained. The semantics of the elements are summarized in Table 5

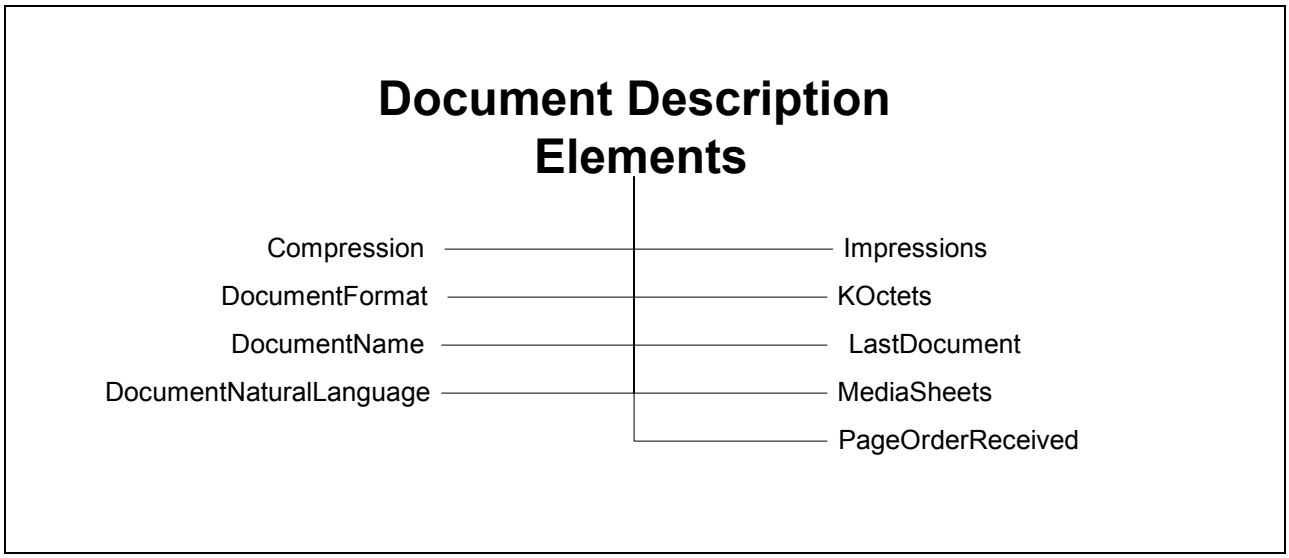


Figure 11 Document Description Elements

4.4 Processing Elements

Processing elements are instructions to be applied to jobs and documents. They indicate such things as the priority for scheduling a job or the number of copies for a document. A Printer should

support each Processing Element that represents a feature of the Printer. The Processing elements are split into two groups. One groups applies to Jobs and the other to Documents.

1) Job Processing Elements are processing instructions applied the Job level. See section 4.4.1.
2) Document Processing Elements are specific to documents. See section 4.4.2.

4.4.1 Job Processing Elements

Figure 13 shows the Job Processing Elements. These elements apply to the job as a whole as opposed to each document in the job. The semantics of the elements are summarized in Table 3 along with a brief description of each element.

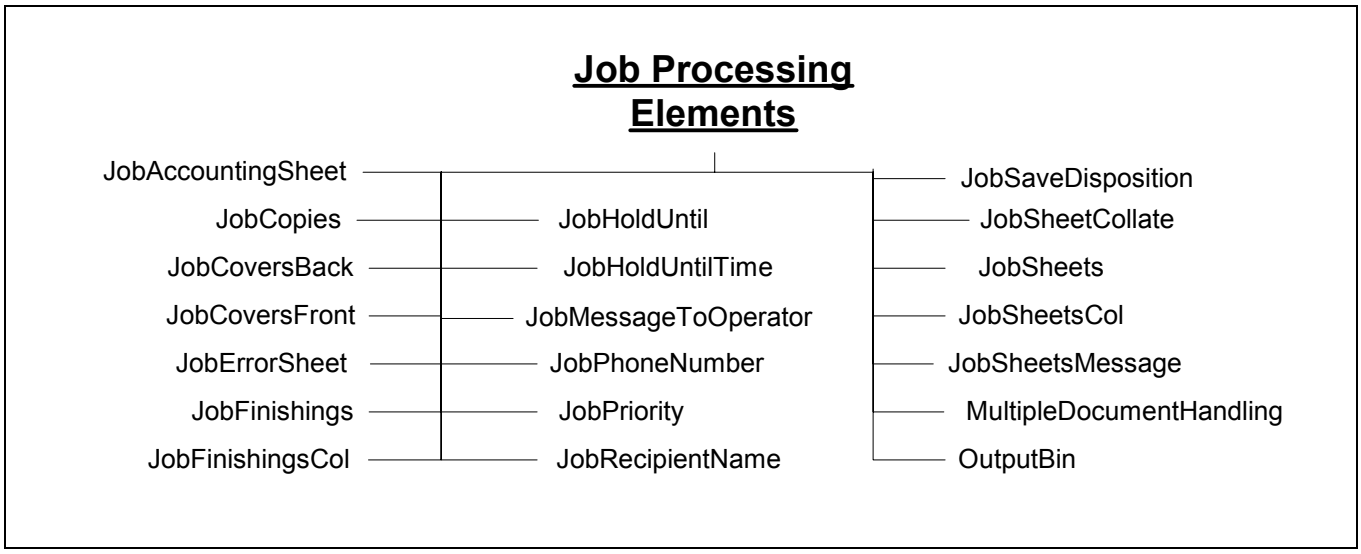


Figure 13 Job Processing Elements

4.4.2 Document Processing Elements

Document Processing Elements are elements that are applied to documents (e.g. “copies”). The Document Processing Elements can be applied at the Job or Document level. If the elements are applied at the Job level, they are the default values for all the Documents in the Job. If the elements are applied at the Document level, they apply only to that Document. The semantics of the Processing elements are summarized in Table 3.

Figure 14 shows the Document Processing Elements. These Elements define features that are used to create final output products. Included in these elements is how multiple physical sheets are manipulated or how the logical pages look on the output media or they determine the quality and resolution of how marks are made on a page. See Table 3 for summary of element semantics.

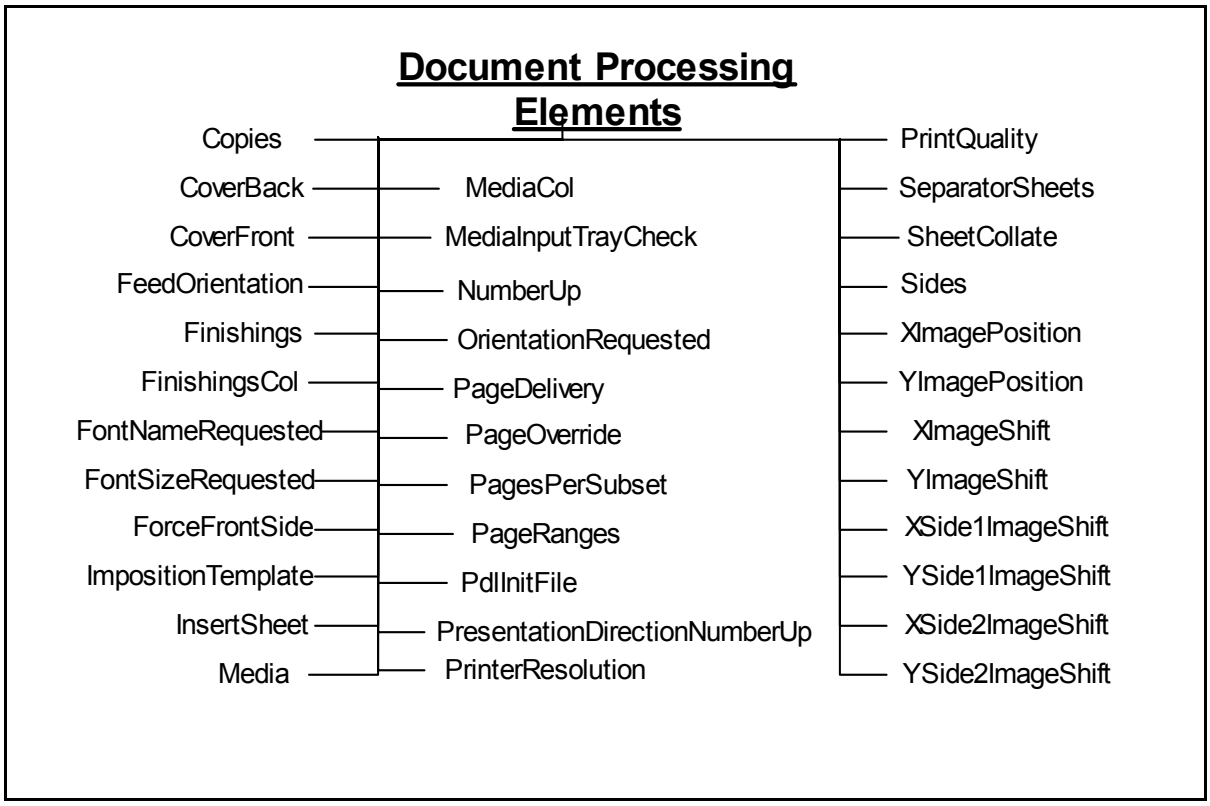


Figure 14 Document Processing Elements

5 Actions

The PWG has defined a number of operations that affect Printers, Jobs and their document. Below is a description of the semantics of these Actions. Naturally different protocol bindings will use differing subsets of the Actions or define new ones. Another difference will be the precise parameters to the Actions. Below is an abstract definition of the Actions. Action Summary

This table summarizes the actions defined for the Job and Printer. The rest of section 5 provides more details on the semantic of the actions.

Job Creation and Document submission	Job and Document Control	**Status and Information access**	**Printer Control**
CreateJob	CancelCurrentJob	GetDocumentElements	ActivatePrinter
PrintJob	CancelDocument	GetDocuments	DeactivatePrinter
PrintUri	CancelJob	GetJobElements	DisablePrinter
SendDocument	DeleteDocument	GetJobs	EnablePrinter
SendURI	HoldJob	GetPrinterElements	HoldNewJobs
ValidateDocument	PromoteJob	GetPrinterSettableElement Values	PausePrinter

Job Creation and Document submission	Job and Document Control	**Status and Information access**	**Printer Control**
		Values	
ValidateJob	ReleaseJob		PausePrinterAfter CurrentJob
	ReprocessJob		PurgeJobs
	RestartJob		ReleaseHeldNew Jobs
	ResumeJob		RestartPrinter
	ScheduleJobAfter		ResumePrinter
	SetDocumentElements		SetPrinterElements
	SetJobElements		ShutdownPrinter
	SuspendCurrentJob		StartupPrinter

370 **Table 2 - Summary of Actions**

371 *5.1 Job Creation and document submission Actions*

372 This section describes the Job Creation actions that create a Job and the ones that create add
373 Document to a Job. The Job Creation actions are: PrintJob, PrintUri, and CreateJob. The PrintJob
374 action also submits the Document. The PrintUri action submits a URI reference to the Document
375 that the Printer then retrieves when needed at a later time. The CreateJob action only creates the
376 job and the Client must issue subsequent SendDocument and SendUri actions in order to submit
377 document content or a URI reference, respectively, for a job.

378 Processing instructions and descriptive information contained in the arguments of the Job Creation
379 action are combined with Printer supplied information to create a Job instance.

380 The last action in this section is ValidateJob. This operation allows a Client to send a request with
381 all the information to create a Job, except the document content. The Printer does not create a Job
382 but informs the client whether a CreateJob, PrintJob or PrintUri with the same information would
383 have succeeded. This is useful for allowing a Client to verify the processing instructions before
384 sending a large PrintJob request.

385 A concept that is important in the PWG model is a set of instructions that can be applied to a print
386 job. Examples of these instructions include the number of copies and the media to use. These
387 instructions are referred to as Processing Elements. The Processing Elements are made up of the
388 Job Processing Elements (see section 4.4.1) and the Document Processing Elements (see section
389 4.4.2) sent in a Job or Document Creation Action.

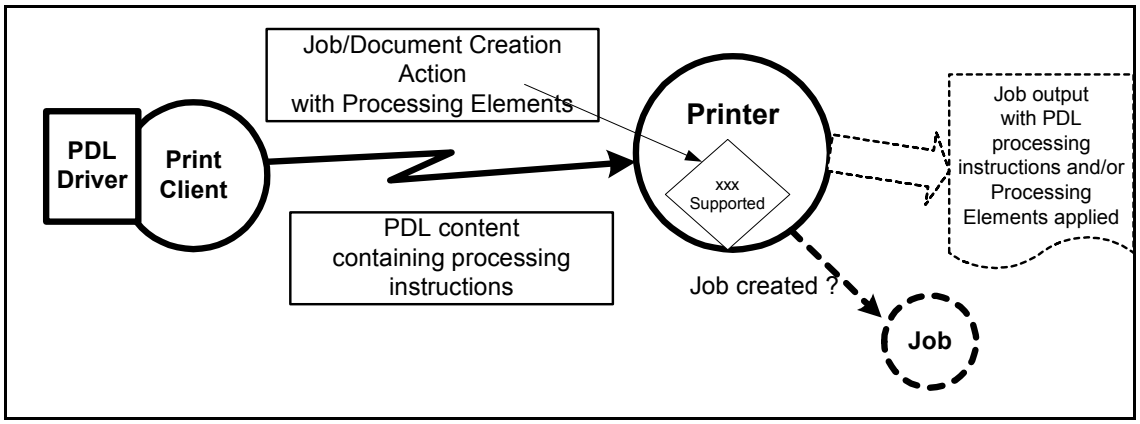


Figure 17 Processing Instruction Processing

In the real world, processing instructions are also contained in the document content for a job. Page Description Languages (PDL) such as PostScript® and PCL® often contain processing instructions. Some environments use a printer specific driver to generate the PDL stream based on feature selections made through a user interface. Given that processing instructions can occur in both the PDL and in an associated Job, the PWG model allows a Printer to declare its capability to resolve this conflict. The Printer's element "PdlOverride" declares if an attempt will be made to override the instructions in the PDL with the instructions in the Job.

There are a wide variety of capabilities in Printers. An instance of a Printer is to subject to changes in its configured capabilities. An example would be an administrative change in the media the Printer supports or disabling two-sided printing. Clients need not check the capabilities of a Printer before creating their Job Processing Elements and submitting a job. Since this is a client/server paradigm, it is always possible that the capabilities could change after checking a Printer's capabilities and before a Job is submitted. On the other hand, a client may use the Printer's configured capabilities to create their Job Processing Elements and submit a job.

The PWG model allows a client to control the Printer's acceptance of a job submission based on the job request and the Printer's current configured capabilities as follows. When the client supplies a 'true' value for the "ElementFidelity" Job Processing element, the Printer must reject the job unless the Printer supports *all* of the supplied Job Processing elements and values. When the client supplies a 'false' value or omits the element, the Printer must accept the job submission and ignore or substitute elements and values, respectively, that it does not support. Note that the "ElementFidelity" Job Processing element covers only the creation of the Job. It is implementation specific how a Printer handles processing a job when the Printer encounters unsupported processing instructions in the document content.

5.1.1 CreateJob

([rfc2911] §3.2.4) Similar to the PrintJob operation (see section 5.1.1), except that in the CreateJob request the Client does not supply Document Data. The client supplies a single set of Job Processing elements that the Printer applies to the Output Document(s) of the job. The "MultipleDocumentHandling" Job Processing element controls whether the Printer produces separate Output Documents or combines the Input Documents into a single Output Document (see section 21).

5.1.2 PrintJob

([rfc2911] §3.2.1) Submit a print job with only one document and supply the document content data. If the Printer accepts the job, it creates the Job object and returns a unique "JobId" element for the Printer and a globally unique "JobUri" element. The Printer also sets the corresponding Job elements with these values.

5.1.3 PrintUri

([rfc2911] §3.2.2) Identical to the PrintJob operation (see section 5.1.1) except that a client supplies a URI reference to the document data.

5.1.3.1 The "MultipleDocumentHandling" Job Processing element

When a client submits a job with more than one Input Document, the "MultipleDocumentHandling" Job element allows the client to specify whether the Printer is to (1) produce corresponding separate Output Documents or (2) combine the Input Documents into a single Output Document. For example, the 'single-document' and 'single-document-new-sheet' values allow the client to staple all of the Input Documents into a single Output Document, with the latter value forcing each Input Document to start on a new sheet (useful when doing two-sided printing). When requesting multiple Copies, the 'separate-document-uncollated-Copies' value results in the Copies of each Input Document being together in an Output set, while the 'separate-document-collated-Copies' value keeps a copy of each Input Document together in an Output set. For example, a job with Input Documents A, B, C and "Copies" = 2 will result in A, A, B, B, C, C or A, B, C, A, B, C, respectively. If the Printer supports multiple documents per job, the Printer must support this Job Processing element with at least one value.

5.1.4 SendDocument

([rfc2911] §3.3.1, [doc-obj] §3) Submits the entire Document Content for the next Input Document of a job created by a previous CreateJob action (see section 5.1.1).

5.1.5 SendUri

([rfc2911] §3.3.2, [doc-obj] §3) Identical to the SendDocument operation (see section 5.1.4) except that a client supplies a URI reference to the Document Content data, instead of supplying the document content.

5.1.6 ValidateDocument

([doc-obj] §3) This operation is used only to verify capabilities of a Printer object against whatever elements are supplied by the client in the ValidateDocument request. By using the ValidateDocument action a client can validate that an identical SendDocument or SendUri would be accepted.

5.1.7 ValidateJob

([rfc2911] §3.2.3) This operation is used only to verify capabilities of a Printer object against whatever elements are supplied by the client in the ValidateJob request. By using the ValidateJob action a client can validate that an identical PrintJob, PrintUri or CreateJob would be accepted.

5.2 Job and Document Control Actions

This section describes the actions that allow a client to control a Job after it has been submitted: CancelJob, HoldJob, ReleaseJob, and RestartJob.

5.2.1 CancelCurrentJob

([admin-ops] §4.2) Allows a client to cancel the current Job in the "processing" or "processing-stopped" state.

5.2.2 CancelDocument

([doc-obj] §3) Prevents the processing of the specified Document if the Document has not yet been processed. Stops the processing of any active Document in an implementation specific manner.

5.2.3 CancelJob

([rfc2911] §3.3.3) Allows a client to cancel a Print Job from the time the Job is created up to the time it is completed, canceled, or aborted.

5.2.4 DeleteDocument

([doc-obj] §3) Removes the Document and its content from the Job.

5.2.5 HoldJob

([rfc2911] §3.3.5) Allows a client to hold a pending Job in the Printer so that it is not eligible for scheduling.

5.2.6 PromoteJob

([admin-ops] §4.4.1) Allows a client to make the pending target job be processed after the current job completes.

5.2.7 ReleaseJob

([rfc2911] §3.3.6) Release a previously held Job so that it is again eligible for scheduling.

5.2.8 ReprocessJob

([admin-ops] §4.1) Allows a client to re-process a copy of a job retained after processing was completed. This operation is the similar to RestartJob except that a new job that is a copy of the target job is created and processed.

5.2.9 RestartJob

([rfc2911] §3.3.7) Restart a job that is retained in the Printer after processing has completed.

5.2.10 ResumeJob

([admin-ops] §4.3.2) Resume the job at the point where it was suspended.

5.2.11 ScheduleJobAfter

([admin-ops] §4.4.2) Request the target job be processed immediately after the specified job

5.2.12 SetDocumentElements

([doc-obj] §3) Set the values of the supplied Document Processing and Document Description elements of the indicated Document. (Was SetDocumentAttributes)

5.2.13 SetJobElements

([rfc3380] §4.2) Set the values of the supplied Job Processing, Document Processing and Job Description elements of the indicated Job. (Was SetJobAttributes)

5.2.14 SuspendCurrentJob

([admin-ops] §4.4.2) Stop the current job and allow other jobs to be processed instead.

5.3 Status and information Actions

This section describes the actions that allow a client to obtain status and elements of Jobs and Printers: GetJobs, GetPrinterElements, GetJobElements and GetPrinterSupportedValues.

5.3.1 GetDocumentElements

([doc-obj] §3) Returns the requested Document elements or element groups in the indicated Document in the indicated Job. (Was GetDocumentAttributes)

5.3.2 GetDocuments

([doc-obj] §3) Returns the requested Document elements or element groups in all Documents in the indicated Job.

5.3.3 GetJobElements

([rfc2911] §3.3.4) Returns the values of the requested job elements and/or element groups of a Job (i.e., Job Description, Job Status, Job Processing and Document Processing). (Was GetJobAttributes)

5.3.4 GetJobs

([rfc2911] §3.3.4) Retrieve the list of Jobs belonging to the Printer. The Client may supply some simple filters (e.g. “MyJobs, “Limit) to control which jobs will be returned. The Client may supply a list of Job element and/or element group names to be returned in the response (See 5.3.3). A group of Job elements will be returned for each returned Job.

5.3.5 GetPrinterElements

([rfc2911] §3.2.5) Returns the values of the requested printer elements and/or element groups of a Printer (i.e. Printer Status, Printer Description, Processing Supported, Processing Default, Processing Ready). (Was GetPrinterAttributes)

5.3.6 GetPrinterSettableElementValues

([rfc3380] §4.3) Returns the possible values of each of the requested Printer Processing and Printer Description elements that may be set with the SetPrinterElements action. (Was GetPrinterSupportedValues)

5.4 Printer Control Actions

This section describes actions which allow a client to control a Printer and may require operator credentials: PausePrinter, ResumePrinter, PurgeJobs, DisablePrinter, EnablePrinter, and SetPrinterElements.

5.4.1 ActivatePrinter

([admin-ops] §3.4.2) The Printer will now start sending jobs to its Output Devices or Subordinate Printers and begin accepting all requests.

5.4.2 DeactivatePrinter

([admin-ops] §3.4.1) The Printer will now stop sending any more jobs to its Output Devices or Subordinate Printers and begin refusing all requests except ActivatePrinter, SendDocument, and SendUri requests and query requests.

5.4.3 DisablePrinter

([adm-ops] §3.1.1) Prevents the Printer from accepting any more Job Creation operations. The Printer sets the PrinterIsAcceptingJobs Printer Status element to ‘false’.

5.4.4 EnablePrinter

([adm-ops] §3.1.2) Allows the Printer to start accepting Job Creation operations. The Printer sets the PrinterIsAcceptingJobs Printer Status element to ‘true’.

5.4.5 HoldNewJobs

([admin-ops] §3.3.1) Complete the current 'pending' and 'processing' Jobs but do not start processing any subsequently created Jobs.

5.4.6 PausePrinter

([rfc2911] §3.2.7) Stops the Printer object from scheduling jobs. Job processing should also cease.

5.4.7 PausePrinterAfterCurrentJob

([admin-ops] §3.2.1) Stops the Printer from starting to send jobs to any of its Output Devices or Subordinate Printers.

5.4.8 PurgeJobs

([rfc2911] §3.2.9) Removes all jobs from the Printer, regardless of their state.

5.4.9 ReleaseHeldNewJobs

([admin-ops] §3.3.2) Undo the effect of HoldNewJobs and release all Jobs held as a consequence of HoldNewJobs.

5.4.10 RestartPrinter

([admin-ops] §3.5.1) This action has the effect of a software re-boot.

5.4.11 ResumePrinter

([rfc2911] §3.2.8) Resume the processing and scheduling of Jobs in the Printer.

5.4.12 SetPrinterElements

([rfc3380] §4.1) Set the values of the supplied Printer Processing and Printer Description elements. (Was SetPrinterAttributes)

5.4.13 ShutdownPrinter

([admin-ops] §3.5.2) Stop processing jobs without losing any jobs and make the Printer no longer available for any Actions.

5.4.14 StartupPrinter

([admin-ops] §3.5.3) Allows a hosted implementation of the Printer to be started after the host is available.

6 Globalization

The two aspects of globalization being addressed are the character sets and natural language of the human readable strings. Determining what character set is being used is left up to the protocol mapping of this semantic model. The natural language being used is represented in the Printer and the Job. The Printer declares the natural language it uses for all its semantic elements of type string. Administrators are free to change the localization and the values in the string elements. Each job creator declares the natural language for the Job and all its contained Documents. Not all string elements are treated the same.

Any semantic element that is labeled type1, type2 or type3 keyword in the constraint column is the following tables do not have any globalization issues from the Printer's point of view. They are simply a sequence of octets that have a semantic meaning attached to them. The fact that the sequence of octets can be interpreted as ASCII strings is unimportant. The keywords are intended for consumption by automata. We leave it to Client implementations to determine how the keywords will be presented to end-users.

There are also strings with specific formats. These formats are URI, URI Scheme, MIME, IEEE 1284 and DateTime. Any semantic element whose string value must adhere to one of the previous formats is excluded from this discussion.

There are a few elements whose value is set by automata. Those values are "JobStateMessage", "DocumentStateMessage" and "PrinterStateMessage". If the semantic model is mapped to a

protocol that allows the Client to request a language, the Printer will return these strings in the requested language if possible.

All the remaining Printer element strings are assumed to be in the Printer's language. All the remaining Job element strings are assumed to be in the language of the Job.

7 Summary of elements

This section summarizes the elements for the Document, Job and Printer objects. Included in the definition are the processing elements that can be applied at either the Job or Document level. For each element, the tables contain the element name, whether the element is multi-valued, its syntax, constraints, a short description and a reference to the Document where the semantics of the element is completely specified. The basic syntax types are "Boolean", "String" and "Integer". "Complex" types are a container for elements of any type. Members are listed in the description field. "RangeOfInteger" is a complex type that contains "Upperbound" and "Lowerbound" integer value members. "Resolution" is a complex type that contains "CrossFeedDir" and "FeedDir" integer value members and a "Units" string value member.

7.1 Processing Elements (Job and Document)

* Group key: J=Job Processing Elements, D=Document Processing Elements

Table 3 - Processing Elements (Job and Document)

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Copies		Integer	1:MAX	D	[rfc2911] §4.2.5
The number of copies of the Output Document(s) to be printed. (See also JobCopies Job element)					
CoverBack		*complex*		D	[PWG5100.3] §3.1
The back cover to apply this Document. *(Includes Media/MediaCol, CoverType)*					
CoverFront		*complex*		D	[PWG5100.3] §3.1
The front cover to apply to this Document. *(Includes Media/MediaCol, CoverType)*					
CoverType		String	Type2 keyword	D	[PWG5100.3] §3.1.2
Indicates if covers are requested and which sides will contain print stream pages. (Keywords: no-cover, print-none, print-front, print-back, print-both) (See CoverBack & CoverFront for use)					
DocumentCopies	Yes	RangeOfInteger		J	[PWG5100.4] §5.1.3
Specifies which copies of an Output Document to apply these document override elements. (See DocumentOverrides for use)					
DocumentOverrides	Yes	complex		J	[PWG5100.4] §5.1

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Provides for the overriding of processing instructions on a document basis. Applied to job, see PageOverrides for overrides supplied at the document level. *(Includes InputDocuments/OutputDocuments, DocumentCopies, DocumentFormat, DocumentName, Compression, DocumentNaturalLanguage, PageRanges, and any other processing element that affects documents) NOTE: Deprecated in favor of supporting and using the Document Object*					
FeedOrientation		String	Type3 keyword	D	[prod-print2] §5.1
Specifies the media edge that is fed into the print engine from the paper tray. *(Keywords: long-edge-first, short-edge-first)*.					
Finishings	Yes	String	Type2 keyword	D	[rfc2911] §4.2.6 [PWG5100.1] §2
Identifies the finishings that the Printer uses for each copy of the Output Document. (See also JobFinishings Job element) *(Keywords: bale, bind, bind-bottom, bind-left, bind-right, bind-top, booklet-maker, cover, edge-stitch, edge-stitch-bottom, edge-stitch-left, edge-stitch-right, edge-stitch-top, fold, jog-offset, none, punch, saddle-stitch, staple, staple-bottom-left, staple-bottom-right, staple-dual-bottom, staple-dual-left, staple-dual-right, staple-dual-top, staple-top-left, staple-top-right, trim)*					
FinishingsCol		complex		D	[PWG5100.3] §3.2
Enables an end user to specify detailed finishing options not possible with the "Finishings" element for the Output Document. (See also JobFinishingsCol Job element) *(Includes FinishingTemplate, Stitching)*					
FinishingTemplate		String	Maxlength=1023	JD	[PWG5100.3] §3.2.1
A string specifying some particular finishing operation. (See FinishingsCol/JobFinishingsCol for use)					
FontNameRequested		String	Maxlength=255	D	[prod-print2] §5.2
Specifies the font name if the document data is in a format that does not have inherent font information (e.g., 'text/plain'), otherwise, this element is ignored.					
FontSizeRequested		Integer	1:MAX	D	[prod-print2] §5.3
Specifies the font size in points (1/72 of an inch) if the document data is in a format that does not have inherent font information (e.g., 'text/plain'), otherwise, this element is ignored.					
ForceFrontSide	yes	Integer		D	[PWG5100.3] §3.3
Forces the specified pages to be printed on the front side of a sheet of media. The pages of the output document start at 1.					
ImpositionTemplate		String	Type2 keyword	D	[PWG5100.3] §3.4
Specifies imposition method for laying out finished page images onto the surface of output media. *(Keywords: none, signature)*					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
InputDocuments	Yes	RangeOfInteger		D	[PWG5100.4] §5.1.1
Specifies the input documents for override processing. (See DocumentOverrides for use) NOTE: Deprecated since DocumentOverrides are deprecated					
InsertAfterPageNumber		Integer		D	[PWG5100.3] §3.5.1
Specifies the input page after which the Insert Sheet will be placed. (See InsertSheet for use)					
InsertCount		Integer		D	[PWG5100.3] §3.5.2
Specifies the number of Insert Sheet to insert. (See InsertSheet for use)					
InsertSheet	Yes	complex		D	[PWG5100.3] §3.5
Specifies how Insert Sheets are to be inserted into the sequence of media sheets that are produced for each copy of the documents. *(Includes InsertAfterPageNumber, InsertCount, Media/MediaCol)*					
JobAccountingOutputBin		String	Type3 keyword	J	[PWG5100.3] §3.8.3
Specifies the output bin where the accounting sheet is to be placed. (See JobAccountingSheet for use) *(Keywords: top, middle, bottom, side, left, right, center, rear, face-up, face-down large-capacity, my-mailbox, stacker-N, mailbox-N, tray-N *Note: N is replaced by a cardinal number, *Note: See [PWG5100.2 §2.1 for description of keywords)*					
JobAccountingSheet		complex		J	[PWG5100.3] §3.8
Specifies the accounting sheet for a job. *(Includes JobAccountingSheetType, Media/ MediaCol, JobAccountingOutputBin)*.					
JobAccountingSheetType		String	Type3 keyword	J	[PWG5100.3] §3.8.1
Specifies the accounting sheet format for a job. (See JobAccountingSheet for use) *(Keywords: none, standard)*					
JobCopies		Integer	1:MAX	J	[rfc2911] §4.2.5 [doc-obj]
The number of copies of the Job to be printed. (See also Copies Document Processing element)					
JobCoverBack		*complex*		J	[PWG5100.3] §3.1 [doc-obj]
The back cover to apply this Job. *(Includes Media/MediaCol, CoverType)*					
JobCoverFront		*complex*		J	[PWG5100.3] §3.1 [doc-obj]
The front cover to apply to this Job. *(Includes Media/MediaCol, CoverType)*					
JobErrorSheet		complex		J	[PWG5100.3] §3.9

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	Specifies the error sheet for a job. *(Includes JobErrorSheetType, JobErrorSheetWhen, Media/MediaCol)*.				
JobErrorSheetType		String	Type3 keyword	J	[PWG5100.3] §3.9.1
	Specifies the error sheet format for a job. (See JobErrorSheet for use) *(Keywords: none, standard)*				
JobErrorSheetWhen		String	Type2 keyword	J	[PWG5100.3] §3.9.2
	Specifies the accounting sheet format for a job. (See JobErrorSheet for use) *(Keywords: on-error, always)*				
JobFinishings	Yes	String	Type2 keyword	J	[rfc2911] §4.2.6 [doc-obj]
	Identifies the finishing that the Printer uses for each job copy of the Job. (See also Finishings Document element) *(Keywords: none, staple, punch, cover, bind, saddle-stitch, edge-stitch, staple-top-left, staple-bottom-left, staple-top-right, staple-bottom-right, edge-stitch-left, edge-stitch-top, edge-stitch-right, edge-stitch-bottom, staple-dual-left, staple-dual-top, staple-dual-right, staple-dual-bottom)*				
JobFinishingCol		complex		J	[PWG5100.3] §3.2 [doc-obj]
	Enables an end user to specify detailed finishing options not possible with the "JobFinishings" element. . (See also FinishingsCol Document element) *(Includes FinishingTemplate, Stitching)*				
JobHoldUntil		String	Type3 keyword	J	[rfc2911] §4.2.2
	Specifies the named time period during which the Job must become a candidate for printing. (keywords: no-hold, indefinite, day-time, evening, night, weekend, second-shift, third-shift)				
JobHoldUntilTime		String	DateTime [rfc1123]	J	[prod-print2] §5.4
	Specifies the date and time after which the Job must become a candidate for printing. (example: Fri, 03 May 2002 08:49:37 GMT)				
JobMessageToOperator		String	Maxlength=1023	J	[PWG5100.3] §3.10
	Message from the end user to indicate something about the processing of this Job. (example: "Call 555-1234 before running this job")				
JobPhoneNumber		String	Maxlength=127	J	[prod-print2] §5.5
	Contains the contact telephone number for this Job.				
JobPriority		Integer	1:100	J	[rfc2911] §4.2.1
	Priority for scheduling the Job. A higher value specifies a higher priority.				
JobSaveDisposition		Complex		J	[prod-print2] §5.7

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	Specifies that the Printer is to save the job as a file that can be re-printed on demand anytime in the future using the Print-URI operation (see section 5.1.3).) *(Includes SaveDisposition, SaveInfo)*				
JobSheets		String	type3 keyword	J	[rfc2911] §4.2.3 [PWG5100.3] §6.2
	Specifies which job start/end sheet(s), will be printed with a job. *(Keywords: none, standard, job-start-sheet, job-end-sheet, job-both-sheets, first-print-stream-page)*				
JobSheetsCol		complex		J	[PWG5100.3] §3.11
	Allows the client to specify the media for the JobSheet. *(Includes JobSheets, Media/MediaCol)*				
JobSheetCollate		String	Type2 keyword	J	[rfc3381] §3.1 [doc-obj]
	Specifies if each copy of each printed document in a job are to be in sequence. (See also SheetCollateDocument element) *(Keywords: uncollated, collated)*				
JobSheetMessage		String	Maxlength=1023	J	[PWG5100.3] §3.12
	Conveys a message that is delivered with the job.				
Media		String	type3 keyword	D	[rfc2911] §4.2.11
	The name of the medium that the Printer uses for all impressions of the Job. *(Keyword examples: na_letter_8.5x11in, iso_a4_210x297mm, na_monarch_3.875x7.5in. See [pwg5101.1])*				
MediaCol		complex		D	[PWG5100.3] §3.13
	Enables a client end user to submit a list of media characteristics to the Printer as a way to more completely specify the media to be used than the Media element. *(Includes MediaBackCoating, MediaColor, MediaFrontCoating, MediaGrain , MediaHoleCount, MediaInfo, MediaKey, MediaMaterial, MediaOrderCount, MediaPrePrinted, MediaRecycled, MediaSize, MediaThickness, MediaTooth, MediaType, MediaWeightMetric)*				
MediaBackCoating		String	Type3 keyword	D	[PWG5100.3] §3.13.10
	Indicates the pre-process coating applied to the back of the media. (See MediaCol for use) *(Keywords: none, glossy, high-gloss, semi-gloss, satin, matte)*				
MediaColor		String	Type3 keyword	D	[PWG5100.3] §3.13.4
	Indicates the desired color of the media being specified. (See MediaCol for use) *(Keywords: no-color, white, pink, yellow, blue, green, buff, goldenrod, red, gray, ivory, orange)*				
MediaFrontCoating		String	Type3 keyword	D	[PWG5100.3] §3.13.10
	Indicates the pre-process coating applied to the front of the media. (See MediaCol for use) *(Keywords: none, glossy, high-gloss, semi-gloss, satin, matte)*				
MediaGrain		String	Type3 keyword	D	[prod-print2] §8.4.2

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	Indicates the grain of the media. (See MediaCol for use) *(Keywords: x-direction, y-direction)*				
MediaHoleCount		Integer		D	[PWG5100.3] §3.13.6
	Indicates the number of pre-drilled holes in the desired media. (See MediaCol for use)				
MediaInfo		String	Maxlength=255	D	[PWG5100.3] §3.13.3
	Specifies information that helps describe the media instance. Intended for human consumption. (See MediaCol for use)				
MediaInputTrayCheck		String	Type3 keyword	D	[PWG5100.3] §3.14
	Indicates that the characteristics of the media in the identified input tray must match the characteristics of the media identified by the "media" or "media-col" element. *(Keywords: top, middle, bottom, side, large-capacity, envelope, main, manual. See [RFC2911] Appendix C)*				
MediaKey		String	Type3 keyword	D	[PWG5100.3] §3.13.1
	The name of the media represented as a keyword or name. Values are the same as the keyword and name values for the Media Document Processing element and represent the same media, except for media size and input tray keywords. (See MediaCol for use)				
MediaMaterial		String	Type3 keyword	D	[prod-print] §8.4.3
	The material of the media. (See MediaCol for use) *(Keywords: aluminum, dry-film, paper, polyester, wet-film)*				
MediaOrderCount		Integer	1:MAX	D	[PWG5100.3] §3.13.7
	Indicates the number of sheets, within an ordered sequence of sheets; after which the sequence begins to repeat. (See MediaCol for use)				
MediaPrePrinted		String	Type3 keyword	D	[PWG5100.3] §3.13.11
	Indicates the pre-printed characteristics of the desired media. (See MediaCol for use) *(Keywords: blank, pre-printed, letter-head)*				
MediaRecycled		String	Type3 keyword	D	[PWG5100.3] §3.13.10
	Indicates the recycled characteristics of the media. (See MediaCol for use*) (Keywords: none, standard)*				
MediaSize		Complex		D	[PWG5100.3] §3.13.8
	Explicitly specifies the numerical media width and height dimensions. (See MediaCol for use) *(Includes XDimension, YDimension)*				
MediaSizeName		String	Type3 keyword	D	Need UPnP ref
	The medium size that the Printer uses for all impressions of the Job. (See MediaCol for use) *(Keywords: na_letter_8.5x11in. See [pwg5101.1] §5)*				
MediaThickness		Integer	1:MAX	D	[prod-print2] §8.4.4
	The thickness of the media in units of one hundredth of a millimeter. This unit is equivalent to 1/2540 th of an inch. (See MediaCol for use)				

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
MediaTooth		String	Type3 keyword	D	[prod-print2] §8.4.1
The tooth (or roughness) of the media. (See MediaCol for use) *(Keywords: fine, medium, coarse)*					
MediaType		String	Type3 keyword	D	[PWG5100.3] §3.13.2
The medium type that the Printer uses for all impressions of the Job. (See MediaCol for use) *(Keywords: stationery, transparency envelope, envelope-plain, envelope-window, continuous, continuous-long, continuous-short, tab-stock, pre-cut-tabs, full-cut-tabs, multi-part-forms, labels, multi-layer, screen, screen-paged, photographic, cardstock, other See also [pwg5101.1] §3)*					
MediaWeightMetric		Integer		D	[PWG5100.3] §3.13.9
Indicates the weight of the desired media rounded to the nearest whole number of grams per square meter. (See MediaCol for use)					
MultipleDocumentHandling		String	type2 keyword	J	[rfc2911] §4.2.4
Controls whether Input Document in multi-Document jobs are combined into a single Output Document or are kept as separate Output Document Useful for application of Finishings and the placement of one or more print-stream pages into impressions and onto media sheets for multi-Document Jobs. *(Keywords: single-Document, separate-Document-uncollated-Copies, separate-Document-collated-Copies, single-Document-new-sheet)*					
NumberUp		Integer	1:MAX	D	[rfc2911] §4.2.9
Indicates the number of Input pages that the Printer is to image on one impression.					
OrientationRequested		String	type2 keyword	D	[rfc2911] §4.2.10
The desired orientation for printed pages for document formats that don't have a built-in orientation. *(Keywords: portrait, landscape, reverse-landscape, reverse-portrait)*					
OutputBin		String	Type2 keyword	J	[PWG5100.2] §2.1
Specifies the output bin where the job is to be delivered. *(Keywords: bottom, center, face-down, face-up, large-capacity, left, mailbox-N*, middle, my-mailbox, rear, right, side, stacker-N*, top, tray-N*. *Note: N is replaced by a cardinal number)*					
OutputDocuments	Yes	RangeOfInteger		D	[PWG5100.4] §5.1.2
Specifies the output documents for override processing. (See DocumentOverrides for use) NOTE: Deprecated DocumentOverrides are deprecated.					
PageDelivery		String	Type2 keyword	D	[PWG5100.3] §3.15
Indicates whether the pages of the job are to be delivered to the output bin or finisher in the same page order as the original document and face up or face down. . See the PageOrderReceived Document Description element and the CurrentPageOrder Document Status element. *(Keywords: reverse-order-face-down, reverse-order-face-up, same-order-face-down, same-order-face-up, system-specified)*					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
PageOverrides	Yes	complex		D	[PWG5100.4] §5.2
Provides for the overriding of processing instructions on a page basis. *(Includes InputDocuments/OutputDocuments, DocumentCopies, Pages, Sides, media and any other processing element that affects pages)*					
Pages	yes	RangeOfInteger		D	[PWG5100.4] §5.2.4
Specifies a range of pages in the document data. (See PageOverrides for use)					
PagesPerSubset	yes	Integer		D	[PWG5100.4] §5.3
Combines all of the Input Pages of all of the Input Documents into a single stream of Input-Pages. Then the Printer partitions that single stream into contiguous subsets of Input-Pages according to the list of integers. Each subset is defined to be an Output-Document.					
PageRanges	yes	RangeOfInteger		D	[RFC2911] §4.2.7
Specifies a range of pages in the document data to be output.					
PdlInitFile	Yes	Complex		D	[prod-print2] §5.8
Controls initialization of the Printer's Page Description Language (PDL) interpreter. (Includes PdlInitFileEntry, PdlInitFileLocation. PdlInitFileName)					
PdlInitFileEntry		String	Maxlength=255	D	[prod-print2] §5.8.1.3
Specifies an entry point within the init file at which the PDL interpreter starts. (See PdlInitFile for use)					
PdlInitFileLocation		String	Maxlength=1023	D	[prod-print2] §5.8.1.1
Contains a URL that specifies the path to the directory where the initialization file for the Printer's PDL interpreter will be found. (See PdlInitFile for use)					
PdlInitFileName		String	Maxlength=255	D	[prod-print2] §5.8.1.2
Specifies the name of the PDL interpreter's initialization file within the directory specified by the PdlInitFileLocation element. (See PdlInitFile for use)					
PresentationDirectionNumberUp		String	Type2 keyword	D	[PWG5100.3] §3.17
Specifies the placement order of the page images on a Finished-Page Image with the "number-up" element. *(Keywords: toright-tobottom, tobottom-toright, toleft-tobottom, tobottom-toleft, toright-totop, totop-toright, toleft-totop)*					
PrintQuality		String	type2 keyword	D	
The print quality that the Printer uses for the Job. *(Keywords: draft, normal, high)*					
PrinterResolution		resolution		D	RFC2911] §4.2.12
The resolution that Printer uses for the Job in cross-feed and feed direction in units of dpi or dpcm.					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
ProofPrint		Complex		J	[prod-print2] §5.9
Specifies the elements for zero or more proof prints of the job that are to be printed prior to the printing the full run of the job. (Includes ProofPrintCopies , Media/MediaCol and any other Processing elements).					
ProofPrintCopies		Integer	0:MAX	J	[prod-print2] §5.9.1
Specifies the number of proof prints to be printed prior to the printing the full run of the job. (See ProofPrint for use)					
SaveDisposition		String	type3 keyword	J	[prod-print2] §5.7.1.1
Specifies whether the Printer must print and/or save the job. (See JobSaveDisposition for use) *(Keywords: none, print-save, save-only)*					
SaveDocumentFormat		String	MimeMediaType [rfc2046], [rfc2048]	J	[prod-print2] §5.7.1.2.3.3
Indicates the document format in which the Printer saves the Document Data. (See DocumentFormat Document Description element) (See SaveInfo for use)					
SaveInfo	Yes	complex		J	[prod-print2] §5.7.1.2
Contains sets of elements that each tells the Printer how to create each copy of the saved job. (See JobSaveDisposition for use) *(Includes SaveLocation, SaveName, SaveDocumentFormat)*					
SaveLocation		String	Maxlength=1023	J	[prod-print2] §5.7.1.2.3.1
Specifies the path to the directory as a URI where the Printer saves the Document Data and other Job information. (See SaveInfo for use)					
SaveName		String	Maxlength=255	J	[prod-print2] §5.7.1.2.3.2
Specifies the name of the saved job in the directory specified by the "save-location" member element. The value may be a relative path. (See SaveInfo for use)					
SeparatorSheets		complex		D	[PWG5100.3] §3.18
Specifies the separator sheets to be printed with the Document. *(Includes SeparatorSheestType, Media/MediaCol)*					
SeparatorSheetsType		String	Type3 keyword	D	[PWG5100.3] §3.18.1
Specifies the separator sheets type. (See SeparatorSheets for use) *(Keywords: none, slip-sheets, start-sheet, end-sheet, both-sheets)*					
SheetCollate		String	Type2 keyword	D	[rfc3381] §3.1

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Specifies if the media sheets of each copy of each printed document in a job are to be in sequence. *(Keywords: uncollated, collated)*					
Sides		String	type2 keyword	D	[rfc2911] §4.2.8
Indicates how an impression is to be placed upon the side(s) of the media. *(Keywords: one-sided, two-sided-long-edge, two-sided-short-edge, two-sided-long-edge, tumble)*					
Stitching		complex		D	[PWG5100.3] §3.2.2
Provides detailed stitching parameters. (See FinishingsCol/JobFinishingsCol for use) *(Includes StitchingReferenceEdge, StitchingOffset, StitchingLocations)*					
StitchingLocations	yes	Integer		D	[PWG5100.3] §3.2.2.3
The distance along the stitching axis where a stitch will be placed in hundredths of a millimeter. (See Stitching for use)					
StitchingOffset		Integer		D	[PWG5100.3] §3.2.2.2
The perpendicular distance from the reference edge to the stitching axis in hundredths of a millimeter. (See Stitching for use)					
StitchingReferenceEdge		String	type2 keyword	D	[PWG5100.3] §3.2.2.1
Specifies the stitching reference edge of the output media. (See Stitching for use) *(Keyword: bottom, top, left, right)*					
XDimension		Integer	0:MAX	D	[PWG5100.3] §3.13.8.1
Size of the media in hundredths of a millimeter along the bottom edge. (See MediaSize for use)					
XImagePosition		String	type2 keyword	D	[PWG5100.3] §3.19.2
Causes the specified point of the Finished-Page Image to be positioned at a specified location. *(Keywords: none, center, left, right)*					
XImageShift		Integer		D	[PWG5100.3] §3.19.3
Causes the Finished-Page Image to be shifted in position with respect to the x-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.					
Xside1ImageShift		Integer		D	[PWG5100.3] §3.19.4
Causes each Finished-Page Image that would be placed on the front side of a sheet to be shifted in position with respect to the x-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.					
Xside2ImageShift		Integer		D	[PWG5100.3] §3.19.5

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	Causes each Finished-Page Image that would be placed on the backside of a sheet to be shifted in position with respect to the x-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.				
YDimension		Integer	0:MAX	D	[PWG5100.3] §3.13.8.2
	Size of the media in hundredths of a millimeter along the left edge. (See MediaSize for use)				
YImagePosition		String	type2 keyword	D	[PWG5100.3] §3.19.6
	Causes the specified point of the Finished-Page Image to be positioned at a specified location. *(Keywords: none, center, top, bottom)*				
YImageShift		Integer		D	[PWG5100.3] §3.19.7
	Causes the Finished-Page Image to be shifted in position with respect to the y-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.				
Yside1ImageShift		Integer		D	[PWG5100.3] §3.19.8
	Causes each Finished-Page Image that would be placed on the front side of a sheet to be shifted in position with respect to the y-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.				
Yside2ImageShift		Integer		D	[PWG5100.3] §3.19.9
	Causes each Finished-Page Image that would be placed on the backside of a sheet to be shifted in position with respect to the y-axis of the media. The unit of measure for this element is hundredths of a millimeter. The sign of the value indicates the direction of the shift.				

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605 ## *7.2 Job Elements (Status and Description)*

606 * Group Key: S=Status, D=Description

607 **Table 4- Job Elements (Status and Description)**

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
DateTimeAtCompleted		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.7
	Indicates the date and time at which the Job completed. (example: Fri, 03 May 2002 08:49:37 GMT)				
DateTimeAtCreation		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.5

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	Indicates the date and time at which the Job was created . (example: Fri, 03 May 2002 08:49:37 GMT)				
DateTimeAtProcessing		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.6
	Indicates the date and time at which the Job first began processing. (example: Fri, 03 May 2002 08:49:37 GMT)				
DetailedStatusMessage	Yes	String	Maxlength=1023	S	[rfc2911] §4.3.10
	Specifies additional detailed and technical information about the job. Intended for use by the system administrator or other experienced technical persons and so is not localized by the Printer. (example: "PostScript error: stack overflow") (Was JobDetailedStatusMessage)				
DocumentAccessErrors	Yes	String	Maxlength=1023	S	[rfc2911] §4.3.11
	Information about each Document access error for this job encountered by the Printer. (example: "(404) http://www.company.com/pub/fileToPrint.pdf ") (Was JobDocumentAccessErrors)				
ElementFidelity		Boolean		D	[rfc2911] §15.1
	Allows a user to control whether or not the Printer MUST honor *all* supplied Processing elements in the Job Creation operation. For a 'true' value the Printer rejects the job submission if any of the supplied Processing element values are unsupported. For a 'false' value the Printer MUST accept the job submission and do best effort. Default = 'false' NOTE: Use "JobMandatoryElements" to explicitly specify a *subset* of the supplied elements that the Printer MUST honor. (Was IPPAttributeFidelity)				
ElementsNaturalLanguage		String	Natural language	D	[rfc2911] §4.3.20
	Indicates the natural language of the elements with string syntax that were set by the End User. (Was AttributesNaturalLanguage)				
Impressions		Integer	0:MAX	D	[rfc2911] §4.3.17.2
	The total size in number of impressions in all the Job's Document(s). (Was JobImpressions)				
ImpressionsCompleted		Integer	0:MAX	S	[rfc2911] §4.3.18.2
	The number of impressions completed for the Job so far. (Was JobImpressionsCompleted)				
ImpressionsCompletedCurrentCopy		Integer	0:MAX	S	[rfc3381] §4.4
	The number of impressions completed for the current iteration of this Job so far.				
JobAccountId		String	Maxlength=255	D	[PWG5100.3] §3.6
	Account associated with this Job.				
JobAccountingUserID		String	Maxlength=255	D	[PWG5100.3] §3.7
	Specifies the User ID associated with the "JobAccountId".				
JobCollationType		String	Type2 keyword	S	[rfc3381] §4.1

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Identifies the collation type of the Job. *(Keywords: other, unknown, uncollated-sheets, uncollated-documents, collated-documents)*					
JobId		Integer	1:MAX	S	[rfc2911] §4.3.2
The Printer sets this to the ID of this Job , which is unique for the Printer.					
JobMandatoryElements	Yes	String	Type3 keyword	D	Need reference
Allows a user to list which Processing elements the Printer must honor. The Printer rejects the job submission if *any* of the listed elements are unsupported or contain values that the Printer does not support. All of the remaining supplied elements are best effort. This element is ignored if ElementFidelity is supplied with a 'true' value. (See [rfc2911] §15.1) *(Keywords: none and any Processing element names. Member elements of collection elements are named as Attr.Member. For example, JobSheetsCol.Media)* NOTE: New element to align fidelity with FSG work was JobMandatoryAttributes).					
JobMessageFromOperator		String	Maxlength=127	D	[rfc2911] §4.3.16
Message to the end user indicating the reasons for any management action taken on this Job. (example: "Job canceled due to length", "Pick job up in mailbox")					
JobName		String	Maxlength=255	D	[rfc2911] §4.3.5
The Printer sets this to the client-supplied end-user friendly name for the Job, else the Printer must generate a name from other information. (example: "license agreement memo")					
JobOriginatingUserName		String	Maxlength=255	D	[rfc2911] §4.3.6
The Printer sets this element to the most authenticated printable name that it can obtain (example: "John Doe", \authDomain\John Doe")					
JobPassword		String	Maxlength=255	D	[prod-print2] §4.1
Contains a password supplied by the client encrypted according to method specified by the client in the JobPasswordEncryption element.					
JobPasswordEncryption		String	Type3 keyword	D	[prod-print2] §4.2
Specifies the type of encryption that the client is used for the supplied value of the JobPassword element. *(Keywords: none, md2, md4, md5, sha)*					
JobPrinterMakeAndModel		String	Maxlength=127	S	[prod-print] §6.1
Identifies the make and model of the output device that saved this Job according to the JobSaveDisposition Job Processing element.					
JobPrinterUri		String	uri	S	[rfc2911] §4.3.3
The Printer set this to the URI of Printer that created this Job. (example: ipp://www.company.com/printer)					
JobRecipientName		String	Maxlength=255	D	[prod-print2] §5.6

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Contains the name of the person that is to receive the output of this Job and is commonly printed on the job sheet. It may also be used to reference a database containing delivery instructions for the recipient.					
JobState		String	Type1 keyword	S	[rfc2911] §4.3.7
The current state of this Job (see section 4.2.1.1). See also JobStateReasons element below. *(Keywords: pending, pending-held, processing, processing-stopped, canceled, aborted, completed)*					
JobStateMessage		String	Maxlength=1023	S	[rfc2911] §4.3.6
Specifies information about the "JobState" and "JobStateReasons" elements in human readable text localized by the Printer according to the natural language supplied in the client's query request. (example: "Job completed successfully with warnings" for an English request)					
JobStateReasons	Yes	String	type2 keyword	S	[rfc2911] §4.3.8
Provides additional information about this Job's current state. *(Keywords: aborted-by-system, canceled-at-device, canceled-by-operator, canceled-by-user, completed-successfully, completed-with-errors, completed-with-warnings, compression-error, document-access-error, document-format-error, incoming, interpreting, job-data-insufficient, job-hold-until-specified, job-password-wait, job-restartable, job-resuming, job-saved-successfully, job-save-error, job-saving, job-scheduling, job-spooling, job-streaming, job-suspended, job-suspended-by-operator, job-suspended-by-system, job-suspended-by-user, job-suspending, none, outgoing, printer-stopped, printer-stopped-partly, printing, processing-to-stop-point, proof-print-wait, queued, queued-for-marker, queued-in-device, resources-are-not-ready, resources-are-not-supported, service-off-line, spooling, streaming, submission-interrupted, transforming, unsupported-compression, unsupported-document-format, warnings-detected)*					
JobUri		String	uri	S	[rfc2911] §4.3.1
The Printer sets this to the URI for this Job. (example: ipp://www.company.com/printer/jobs/22) The URI is globally unique.					
KOctets		Integer	0:MAX	D	[rfc2911] §4.3.17.1
The total size of this Job's Document(s) in integral units of 1024 octets. (Was JobKOctets)					
KOctetsProcessed		Integer	0:MAX	S	[rfc2911] §4.3.18.1
the total number of octets processed in integral units of 1024 octets so far. (Was JobKOctetsProcessed)					
MediaSheets		Integer	0:MAX	D	[rfc2911] §4.3.17.3
The total number of media sheets to be produced for this Job's Document(s). . (Was JobMediaSheets)					
MediaSheetsCompleted		Integer	0:MAX	S	[rfc2911] §4.3.18.3

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
	Description (values)				
	The media-sheets completed marking and stacking so far. (Was JobMediaSheetsCompleted)				
MoreInfo		String	uri	S	[rfc2911] §4.3.4
	URI used to obtain information intended for end user consumption about this specific Job/Document. (example: "http://www.company.com/printer/embededjobpage") . (Was JobMoreInfo)				
NumberOfDocuments		Integer	0:MAX	S	[rfc2911] §4.3.12
	The number of Documents in this Job.				
NumberOfInterveningJobs		Integer	0:MAX	S	[rfc2911] §4.3.15
	The number of jobs that are "ahead" of this Job assuming the current scheduled order.				
OutputDeviceAssigned		String	Maxlength=127	S	[rfc2911] §4.3.13
	Identifies the output device to which the Printer has assigned this Job (example: "Pete's Printer")				
PrinterUpTime		Integer	1:MAX	S	[rfc2911] §4.3.14.4
	The amount of time (in seconds) that the Printer has been up and running. See Printer element "PrinterUpTime" (Was JobPrinterUpTime)				
SheetsCompletedCopyNumber		Integer	0:MAX	S	[rfc3381] §4.2
	Number of the copy being stacked for the current Document.				
SheetsCompletedDocumentNumber		Integer	0:MAX	S	[rfc3381] §4.3
	Number of the document in this Job currently being stacked. . The Documents in a Job are numbered 1, 2, 3. A 0 value means no Document is currently being stacked.				
TimeAtCompleted		Integer	MIN:MAX	S	[rfc2911] §4.3.14.3
	The time at which the Job completed in "PrinterUpTime" seconds.				
TimeAtCreation		Integer	MIN:MAX	S	[rfc2911] §4.3.14.1
	The time at which the Job was created in "PrinterUpTime" seconds.				
TimeAtProcessing		Integer	MIN:MAX	S	[rfc2911] §4.3.14.2
	The time at which the Job first began processing in "PrinterUpTime" seconds.				
WarningsCount		Integer	MIN:MAX	S	[PWG5100.4 §6.1
	The total number of warnings that a Printer has generated while processing and printing a Job's Document(s). (Was JobWarningsCount)				

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609 *7.3 Document Elements (Status and Description)*

610 * Group Key: S=Status, D=Description

611 **Table 5 – Document Elements (Status and Description)**

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
Compression		String	Type2 keyword	D	[rfc2911] §4.4.32
Compression algorithm used on the Document Data, if any. *(Keywords: none, deflate, gzip, compress)*					
CurrentPageOrder		String	Type2 keyword	S	[PWG5100.3] §4.1
Indicates the page order of the pages in the document data. Initially set to PageOrderReceived and updated if data is transformed. *(Keywords: 1-to-n-order, n-to-1-order)*					
DateTimeAtCompleted		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.7
Indicates the date and time at which this Document completed. (example: Fri, 03 May 2002 08:49:37 GMT)					
DateTimeAtCreation		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.5
Indicates the date and time at which this Document was created . (example: Fri, 03 May 2002 08:49:37 GMT)					
DateTimeAtProcessing		String	DateTime [rfc1123]	S	[rfc2911] §4.3.14.6
Indicates the date and time at which this Document first began processing. (example: Fri, 03 May 2002 08:49:37 GMT)					
DetailedStatusMessage	Yes	String	Maxlength=1023	S	[rfc2911] §4.3.10
Specifies additional detailed and technical information about this Document. Intended for use by the system administrator or other experienced technical persons. (example: "PostScript error: stack overflow") (Was JobDetailedStatusMessage)					
DocumentAccessErrors	Yes	String	Maxlength=1023	S	[rfc2911] §4.3.11
Information about each Document access error for this Document encountered by the Printer. (example: "(404) http://www.company.com/pub/fileToPrint.pdf ") (Was JobDocumentAccessErrors)					
DocumentFormat		String	MimeMediaType [rfc2046], [rfc2048]	D	[rfc2911] §3.2.1.1
The Document format (i.e., PDL) for this Document. The value "application/octet-stream" has a special meaning. This value is used to indicate that a Printer is capable of auto-sensing the format of the Document. *(Examples: application/octet-stream, application/postscript, application/vnd.hp-PCL, "text/plain; charset=utf-8")*					
DocumentName		String	Maxlength=127	D	[rfc2911] §3.2.1.1
Name for this Document to be used in an implementation specific manner.					
DocumentNaturalLanguage		String	Maxlength=127	D	[rfc2911] §3.2.1.1
Identifies the Natural Language of this Document					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
DocumentNumber		integer		S	[PWG5100.4] §9.2, [doc-obj] §6.1
The order of this document within a job starting at a base of 1.					
DocumentState		String	Type1 keyword	S	[doc-obj] §6.3.2
The current state of this Document. See also DocumentStateReasons element below. *(Keywords: pending, processing, canceled, aborted, completed)*					
DocumentStateMessage		String	Maxlength=127	S	[doc-obj] §6.7
Specifies information about the "DocumentState" and "DocumentStateReasons" elements of this Document in human readable text localized by the Printer according to the language supplied in the client's query request. *(Example: "Document completed successfully with warnings" for an English request)*					
DocumentStateReasons	Yes	String	type2 keyword	S	[doc-obj] §6.5
Provides additional information about this Document's current state. *(Keywords: none, aborted-by-system, canceled-at-device, canceled-by-operator, canceled-by-user, completed-successfully, completed-with-errors, completed-with-warnings, compression-error, document-access-error, document-format-error, incoming, interpreting, outgoing, printing, queued, queued-for-marker, queued-in-device, resources-are-not-ready, resources-are-not-supported, spooling, streaming, submission-interrupted, transforming, unsupported-compression, unsupported-document-format, warnings-detected)*					
DocumentUri		String	Maxlength=1023	S	[rfc2911] §3.2.2
Reference to the Document to be printed (Print by reference)					
Impressions		Integer	0:MAX	D	[rfc2911] §4.3.17.2
The total size in number of impressions in this Document. (Was JobImpressions)					
ImpressionsCompleted		Integer	0:MAX	S	[rfc2911] §4.3.18.2
The number of impressions completed for this Document so far. (Was JobImpressionsCompleted)					
ImpressionsCompletedCurrentCopy		Integer	0:MAX	S	[rfc3381] §4.4
The number of impressions completed for the current iteration of this Document so far.					
JobId		Integer	1:MAX	S	[rfc2911] §4.3.2
The Printer sets this to the ID of the job containing this Document. The ID is unique for the Printer.					
JobUri		String	uri	S	[rfc2911] §4.3.1
The Printer sets this to the URI for the job. (example: ipp://www.company.com/printer/jobs/22) The URI is globally unique.					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
KOctets		Integer	0:MAX	D	[rfc2911] §4.3.17.1
The total size of this Document in integral units of 1024 octets. (Was JobKOctets)					
KOctetsProcessed		Integer	0:MAX	S	[rfc2911] §4.3.18.1
the total number of octets processed in integral units of 1024 octets so far. (Was JobKOctetsProcessed)					
LastDocument		Boolean		D	[rfc2911] §3.3.1
Has a 'true' value if this Document is the last Input Document for the Job. Default = 'false'.					
MediaSheets		Integer	0:MAX	D	[rfc2911] §4.3.17.3
The total number of media sheets to be produced for this Document. (was JobMediaSheets)					
MediaSheetsCompleted		Integer	0:MAX	S	[rfc2911] §4.3.18.3
The media-sheets completed marking and stacking for this Document so far. (Was JobMediaSheetsCompleted)					
MoreInfo		String	uri	S	[rfc2911] §4.3.4
URI used to obtain information intended for end user consumption about this specific Document. (example: "http://www.company.com/printer/embededjobpage") . (Was JobMoreInfo)					
OutputDeviceAssigned		String	Maxlength=127	S	[rfc2911] §4.3.13
Identifies the output device to which the Printer has assigned this Job (example: "Pete's Printer")					
PageOrderReceived		String	Type2 keyword	D	[PWG5100.3] §3.16
Indicates the order of pages in this Document data as supplied with the job. *(Keywords: 1-to-n-order, n-to-1-order)*					
PrinterUpTime		Integer	1:MAX	S	[rfc2911] §4.3.14.4
The amount of time (in seconds) that the Printer has been up and running. (See Printer element "PrinterUpTime") (Was JobPrinterUpTime)					
SheetsCompletedCopyNumber		Integer	0:MAX	S	[rfc3381] §4.2
Number of the copy being stacked for this Document.					
TimeAtCompleted		Integer	MIN:MAX	S	[rfc2911] §4.3.14.3
The time at which this Document completed.					
TimeAtCreation		Integer	MIN:MAX	S	[rfc2911] §4.3.14.1
The time at which this Document was created in "PrinterUpTime" seconds.					
TimeAtProcessing		Integer	MIN:MAX	S	[rfc2911] §4.3.14.2
The time at which this Document first began processing.					

Element Name	Multivalued	Syntax	Constraint	Group*	Reference
Description (values)					
WarningCount		Integer	MIN:MAX	S	[PWG5100.4 §6.1
The total number of warnings that a Printer has generated while processing and printing the Document. (Was Job WarningCount)					

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613 *7.4 Printer Elements (Status and Description)*

614 * Group Key: S=Status, D=Description

615 **Table 6 - Printer Elements (Status and Description)**

Element Name	Multivalued	Syntax	Constraint	Group*	reference
Description (values)					
ColorSupported		boolean		D	[rfc2911] §4.4.26
Indicates if this Printer is capable of any type of color printing at all, including highlight color.					
CompressionSupported	Yes	String	Type3 keyword	D	[rfc2911] §4.4.32
Identifies the set of Compression algorithms for Document content that this Printer supports. *(Keywords: none, deflate, gzip, compress)*					
DeviceId		String	IEEE 1284	D	See Appendix 11.1
An identifier based on IEEE 1284 to identify the device that the Printer represents. Often used to load an appropriate driver on the client device. (example: "MANUFACTURER:ACME;COMMAND SET:PCL,PJL,PS,XHTML-Print+xml;MODEL:LaserBeam 9;COMMENT:example;ACTIVE COMMAND SET:PCL")					
DocumentFormatDefault		String	MimeMediaType [rfc2046], [rfc2048]	D	[rfc2911] §4.4.21
The document format (i.e. PDL) that this Printer has been configured to assume if the client does not specify a document format in any of the actions that supply document content for a Job. The value "application/octet-stream" has a special meaning. This value is used to indicate that a Printer is capable of auto-sensing the format of the document. (examples: application/octet-stream, application/postscript, application/vnd.hp-PCL, "text/plain; charset=utf-8")					
DocumentFormatSupported	YES	String	MimeMediaType	D	[rfc2911] §4.4.22
Identifies both the Document and Image formats supported by this Printer. Specifies the set of Document formats that the Printer supports. (examples: application/octet-stream, application/postscript, application/vnd.hp-PCL, "text/plain; charset=utf-8"). Also specifies the set of Image formats that the Printer supports. (examples: 'image/jpeg' which is a registered MIME Media Type with IANA.					
GeneratedNaturalLanguageSupported	YES	String	Natural Language	D	[rfc2911] §4.4.20

Element Name	Multivalued	Syntax	Constraint	Group*	reference
Description (values)					
Identifies the natural language(s) that the Printer supports in returned values of messages generated by the Printer, that is, the JobStateMessage, DocumentStateMessage, and PrinterStateMessage elements.					
ImpressionsSupported		RangeOfInteger	0:MAX	D	[rfc2911] §4.4.34
Specifies the upper and lower bounds for the number of impressions allowed per job. (Was JobImpressionsSupported)					
JobCreationElementsSupported	YES	String	Type2 keyword	D	[prod-print1] §7.1
Identifies the set of Job Processing and Job Description elements (but not member elements) that this Printer will accept in a JobCreation action (Was JobCreationAttributesSupported)					
JobPasswordEncryptionSupported	Yes	String	type3 keyword	D	[prod-print1] §7.3
Identifies which encryption methods this Printer supports as values of the JobPasswordEncryption Job Description element for Secure Print. *(Keywords: none, md2, md4, md5, sha)*					
JobPasswordSupported		Integer	0:MAX	D	[prod-print1] §7.2
Indicates the maximum length that this Printer will accept for the unencrypted password which the client will encrypt as the value of the JobPassword Description Element.					
JobSpoolingSupported		String	type2 keyword	D	[prod-print1] §7.4
Indicates whether or not the Printer spools Jobs before interpreting the document data (RIPing). *(Keywords: spool, stream, automatic)*					
KOctetsSupported		RangeOfInteger	0:MAX	D	[rfc2911] §4.4.33
Specifies the allowable upper and lower bounds of the total size per Job in integral units of 1024 octets that this Printer will accept. (Was JobKOctetsSupported)					
MaxSaveInfoSupported		Integer	1:MAX	D	[prod-print1] §7.5
Identifies the maximum number of SaveInfo member element collections that this Printer can accept in a job request.					
MediaColDatabase	Yes	Complex		D	[prod-print1] §7.6
Identifies all of the Media supported by this Printer using a collection value for each which identifies the media characteristics. This element is not returned when 'all' is requested. *(Includes any of the MediaCol member elements)*					
MediaSheetsSupported		RangeOfInteger	0:MAX	D	[rfc2911] §4.4.35
Specifies the upper and lower bounds for the number of media sheets allowed per job by this Printer. (Was JobMediaSheetsSupported)					
MultipleDocumentJobsSupported		boolean		D	[rfc2911] §4.4.16

Element Name	Multivalued	Syntax	Constraint	Group*	reference
	Description (values)				
	Indicates whether this Printer supports more than one Document per job, i.e., more than one SendDocument and/or SendUri request per job. A multi-Document per job Printer must implement this element and have a value of 'true'. A single Document per job Printer may either not support this element or support it with a value of 'false'.				
MultipleOperationTimeOut		Integer	1:MAX	D	[rfc2911] §4.4.31
	Identifies the minimum time (in seconds) that this multi-Document per job Printer will wait between actions on an open job before timing out. The actions can add Document to the open Job or close the Job. Timeouts are handled in an implementation specific manner. Multi-Document per job Printers must implement this element. The recommended value is greater than 60 and less than 240.				
NaturalLanguageConfigured		String	Natural language	D	[rfc2911] §4.4.19
	Indicates the natural language of the elements with string syntax that were set by the Administrator or Manufacturer.				
OperationsSupported	Yes	String	type2 keyword	D	[rfc2911] §4.4.15
	The set of supported actions for the Printer and Job. (Keywords: PrintJob, PrintUri, CreateJob, SendDocument, SendURI, ValidateJob, ValidateDocument, CancelJob, HoldJob, ReleaseJob, RestartJob, SetJobElements, SetDocumentElements, CancelDocument, DeleteDocument, GetJobs, GetPrinterElements, GetJobElements, GetDocuments, GetDocumentElements, GetPrinterSupportedValues, PausePrinter, ResumePrinter, PurgeJobs, DisablePrinter, EnablePrinter, SetPrinterElements).				
PagesPerMinute		Integer	0:MAX	D	[rfc2911] §4.4.36
	Specifies the nominal number of pages per minute which may be generated by this Printer.				
PagesPerMinuteColor		Integer	0:MAX	D	[rfc2911] §4.4.37
	Specifies the nominal number of pages per minute which may be generated by this Printer when printing color.				
ParentPrintersSupported	Yes	String	Uri	D	[admin-ops] §7.2
	Contains the URI of the non-leaf Printer for which this Printer is the immediate subordinate.				
PdlOverrideSupported		String	type2 keyword	D	[rfc2911] §4.4.28
	Expresses the ability of this Printer to (1) guaranteed, (2) attempt to, or (3) not attempt to override a Document's processing instructions with Job Processing Elements. *(Keywords: attempted, guaranteed, not-attempted)*				
PrinterCurrentTime		String	DateTime [rfc1123]	S	[rfc2911] §4.4.30
	Indicates the current date and time. (example: Fri, 03 May 2002 08:49:37 GMT)				
PrinterDetailedStatusMessages	Yes	String	Maxlength=1023	S	[prod-print2] §7.7

Element Name	Multivalued	Syntax	Constraint	Group*	reference
	Description (values)				
	Specifies additional detailed and technical information about this Printer for the technical staff.				
PrinterDriverInstaller		String	Uri	D	[rfc2911] §4.4.8
	Intended for consumption by automata to locate the driver installer for this Printer object. (example: "http://www.company.com/printer/installerProgram") Note: This element has not been used by any known implementation and is therefore deprecated.				
PrinterInfo		String	Maxlength=127	D	[rfc2911] §4.4.6
	Descriptive information about this Printer object.(example: "Out of courtesy for others, please print only small (1-5 page) jobs at this printer")				
PrinterIsAcceptingJobs		Boolean		S	[rfc2911] §4.4.23
	Indicates whether this Printer is currently able to accept jobs.				
PrinterLocation		String	Maxlength=127	D	[rfc2911] §4.4.5
	Identifies the location of the device that this Printer represents. *(Example: Pete's Office)*				
PrinterMakeAndModel		String	Maxlength=127	D	[rfc2911] §4.4.9
	Identifies the make and model of the device that this Printer object represents. *(Example: "Xerox Phaser 7700", "HP LaserJet 1000", "Lexmark Optra Color 45")*				
PrinterMessageFromOperator		String	Maxlength=127	D	[rfc2911] §4.4.25
	End user information for this Printer. *(Example: "printer unavailable until 1pm due to preventive maintenance")*				
PrinterMoreInfo		String	uri	D	[rfc2911] §4.4.7
	URI used to obtain information intended for end user consumption about this specific Printer. *(Example: "http://www.company.com/printer/embeddedwebpage")*				
PrinterMoreInfoManufacturer		String	uri	D	[rfc2911] §4.4.10
	URI used to obtain more information for end user consumption about this type of device that this Printer represents. *(Example: "http://www.xerox.com/go/xrx/template/012.jsp?Xcntry=USA&Xlang=en_US&prodID=7700", "http://www.lexmark.com/US/products/overview/0,1224,MjQ5fDE=,00.html")*				
PrinterName		String	Maxlength=127	D	[rfc2911] §4.4.4
	The end-user friendly name of this Printer object. (example: "Pete's Printer")				
PrinterState		String	type1 keyword	S	[rfc2911] §4.4.11
	Identifies the current state of the device(s) that this Printer represents (see Figure 4). (See "PrinterStateReasons" below) *(Keywords: idle, processing, stopped)*				
PrinterStateMessage		String	Maxlength=1023	S	[rfc2911] §4.4.13

Element Name	Multivalued	Syntax	Constraint	Group*	reference
Description (values)					
Information about the "printer- state" and "printer-state-reasons" elements in human readable text localized by the Printer according to the natural language supplied in the client's query request. *(Example: "Printer stopped due to paper jam" for an English request)*					
PrinterStateReasons	Yes	String	type2 keyword	S	[rfc2911] §4.4.12
Augments the "printer-state" element to give more detailed information about this Printer's state. Each keyword value may have a suffix to indicate its level of severity. The three suffixes (levels) are: "Report" (least severe), "Warning", and "Error" (most severe). Keywords without suffixes are assumed to be "Error" (most severe). See reference for semantics of defined keywords. *(Keywords: other, none, connecting-to-device, cover-open, deactivated, developer-empty, developer-low, door-open, fuser-over-temp, fuser-under-temp, hold-new-jobs, input-tray-missing, interlock-open, interpreter-resource-unavailable, marker-supply-empty, marker-supply-low, marker-waste-almost-full, marker-waste-full, media-empty, media-jam, media-low, media-needed, moving-to-paused, opc-life-over, opc-near-eol, output-area-almost-full, output-area-full, output-tray-missing, paused, shutdown, spool-area-full, stopped-partly, stopping, timed-out, toner-empty, toner-low)*					
PrinterUpTime		integer	1:MAX	S	[rfc2911] §4.4.29
The amount of time (in seconds) that this Printer has been up and running					
PrinterUriSupported	Yes	String	uri	D	[rfc2911] §4.4.1
Contains at least one URI for this Printer object. The PrinterUriSupported, UriAuthenticationSupported and the UriSecuritySupported are parallel elements. Each of these elements must have the same cardinality. The "i"th value of each of these elements describes the URI for the printer, the authentication mechanism used and the security method used. *(Example: ipp://www.company.com/printer)*					
QueuedJobCount		integer	0:MAX	S	[rfc2911] §4.4.24
The number of jobs that this Printer has accepted but has not yet completed.					
ReferenceUriSchemesSupported	Yes	String	UriScheme	D	[rfc2911] §4.4.27
Which URI schemes are supported by this Printer to retrieve Document This element must be supported if the Printer is capable of print by reference. *(Example: ftp, http)*					
SubordinatePrintersSupported	Yes	String	Uri	D	[admin-ops] §7.1
Contains the URI of the immediate subordinate Printers associated with this Printer.					
UriAuthenticationSupported	Yes	String	type2 keyword	D	[rfc2911] §4.4.2
The Client authentication mechanism that this Printer object uses to identify the user. (See PrinterUriSupported for additional information) *(Keywords: none, requesting-user-name, basic, digest and certificate)*					
UriSecuritySupported	Yes	String	type2 keyword	D	[rfc2911] §4.4.3

Element Name	Multivalued	Syntax	Constraint	Group*	reference
	Description (values)				
	Identifies the security mechanisms used for accessing this Printer object. (See PrinterUriSupported for additional information) *(Keywords: none, ssl3, tls)*				
VersionsSupported	Yes	String	type2 keyword	D	[rfc2911] §4.4.14
	The versions of the semantics that this Printer supports. *(Keywords: 1.0, 1.1, etc.).*				
WhichJobsSupported	Yes	String	type2 keyword	D	[prod-print2] §7.8
	Contains the set of values that this Printer supports for the WhichJobs operation element that the client may supply in the Get-Jobs operation as a job filter. *(Keywords: aborted, all, canceled, completed, not-completed, pending, pending-held, processing, processing-stopped)*				

8 Status Strings

This Appendix lists the status strings that the Printer returns in each action response.

Table 7 Status strings indicating some degree of success

Status String	Actions where status may occur
Reference	Description of status
successful-ok	Any
Rfc2911	Action succeeded and no requested element were substituted or ignored.
successful-ok-conflicting-attributes	CreateJob, PrintJob, PrintUri, SendDocument, SendUri, ValidateDocument, ValidateJob
	Action succeeded but some elements were conflicting and have been substituted or ignored.
successful-ok-ignored-or-substituted-attributes	CreateJob, PrintJob, PrintUri, SendDocument, SendUri, ValidateDocument, ValidateJob
	Action succeeded but some unsupported elements were ignored or substituted.

Table 8 Status strings indicating error on the part of the Client

Status String	Actions where status may occur
	Description of status
client-error-bad-request	Any
	Malformed syntax or constraint exceeded.
client-error-forbidden	Any
	The Printer understood the request, but is refusing to fulfill it for authentication and/or authorization reasons. The client should not try again even with credentials.
client-error-not-authenticated	Any

Status String	Actions where status may occur
Description of status	
The request requires user authentication. The client may try again with suitable authentication.	
client-error-not-authorized	Any
The requester is not authorized to perform the request. The Client should not try again.	
client-error-not-possible	
The action cannot be performed, because of the state of the target object.	
client-error-timeout	SendDocument, SendUri
The client did not produce a subsequent request within the time that the Printer was prepared to wait.	
client-error-not-found	ActivatePrinter, CancelDocument, CancelJob, DeactivatePrinter, DeleteDocument, DisablePrinter, EnablePrinter, GetDocumentElements, GetDocuments, GetJobElements, GetJobs, GetPrinterElements, GetPrinterSettableElementValues, HoldJob, PromoteJob, ReleaseJob, ReprocessJob, RestartJob, ResumeJob, SendDocument, SendUri, SetDocumentElements, SetJobElements
The target object was not found.	
client-error-gone	Any
The target object is no longer available.	
client-error-request-entity-too-large	Any
The request and/or the Document Content is too large.	
client-error-request-value-too-long	Any
An element value in the request is longer than the Printer supports.	
client-error-document-format-not-supported	CreateJob, PrintJob, SendDocument, SendUri, ValidateDocument, ValidateJob
The document format is not supported.	
client-error-attributes-or-values-not-supported	CreateJob, PrintJob, PrintUri, SendDocument, SendUri, SetDocumentElements, SetJobElements, SetPrinterElements, ValidateDocument, ValidateJob
An element and/or value is not supported and must be in order to carry out the request. The Printer must return the unsupported elements or values in the Unsupported Elements group.	
client-error-uri-scheme-not-supported	PrintUri, SendUri
The URI scheme is not supported.	
client-error-charset-not-supported	Any
The charset is not supported.	
client-error-conflicting-attributes	CreateJob, PrintJob, PrintUri, SendDocument, SendUri, SetDocumentElements, SetJobElements, SetPrinterElements, ValidateDocument, ValidateJob
Some supplied elements are conflicting. The Printer must return them in the	

Status String	Actions where status may occur
Description of status	
Unsupported Elements group.	
client-error-compression-not-supported	PrintJob, PrintUri, SendDocument, SendUri
The compression of the Document Content is not supported.	
client-error-compression-error	PrintJob, PrintUri, SendDocument, SendUri
An error occurred when uncompressing the Document Content.	
client-error-document-format-error	PrintJob, PrintUri, SendDocument, SendUri
An error occurred when interpreting the Document Content.	
client-error-document-access-error	PrintUri, SendUri
An error occurred when the Printer attempted to access the Document Content through the URI supplied.	
client-error-attributes-not-settable	SetDocumentElements, SetJobElements, SetPrinterElements
The supplied element(s) are not settable	

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624 **Table 9 Status strings indicating error on the part of the Printer**

Status String	Actions where status may occur
Reference / Description of status	
server-error-internal-error	Any
An unexpected internal error occurred.	
server-error-operation-not-supported	Any unsupported action
The Printer does not support the requested action.	
server-error-service-unavailable	Any
The Printer is unable to service the request at this time due to overloading or maintenance. The client should try again later as per the "message" Operation element.	
server-error-version-not-supported	Any
The Printer doesn't support the requested major version of the protocol and returns the closest version that it does support.	
server-error-device-error	CreateJob, PrintJob, PrintUri, SendDocument, SendUri
The Printer encountered a device error that causes it to be unable to accept a new request. For example, a paper jam for a Printer that doesn't spool and so cannot accept a new job submission until the jam is fixed.	
server-error-temporary-error	Any
A temporary error such as a buffer full write error, a memory overflow, or a disk full	

Status String		Actions where status may occur
Reference	Description of status	
	condition.	
server-error-not-accepting-jobs		CreateJob, PrintJob, PrintUri
	The Printer is not currently accepting jobs. Its "PrinterIsAcceptingJobs" Printer Description element is 'false'.	
server-error-busy		Any
	A temporary error indicating that the Printer is too busy processing jobs and/or other requests. A Client should try again later.	
server-error-job-canceled		CancelDocument, CancelJob, DeleteDocument, SendDocument, SendUri, SetDocumentElements, SetJobElements
	The job has been canceled by an operator or aborted by the system. For example, while the Client is transmitting the Document Content to the Printer.	
server-error-multiple-document-jobs-not-supported		SendDocument, SendUri
	The Printer doesn't support multiple document jobs and the client attempted to supply a second SendDocument or SendUri request. The Printer's "MultipleDocumentJobsSupported" Printer Description element is 'false'.	
server-error-printer-is-deactivated		Any except Activate-Printer
	`The Printer has been deactivated using the Deactivate-Printer` operation and is only accepting the Activate-Printer	

9 Change Log

5/16/02 PJZ original draft

5/23/02 TH re-organize draft with comments from Melinda Grant

5/26/02 TH detailed review of the draft

5/29/02 PJZ Incorporated comments prior to initial release

6/4/02 SAA Modified to split the Job Attributes into 3 categories:

1) Processing Attributes
2) Content Attributes
3) Job Attributes

The Processing Attributes were further split into 3 subcategories:

1) Rendering attributes

2) Imposition Attributes

3) Finishing Attributes

Added attributes from UPnP Print Basic service template: MediaSize, MediaType, DeviceId attributes.

Removed references to Mandatory vs. Optional since a semantic model should not dictate what is used or not used by the future solutions targeted at specific markets. For example, UPnP picked specific attributes for the SOHO market and did not need all of the Mandatory IPP attributes.

Modified Printer Description Attributes with the following:

1) Added in DeviceId.

2) Changed Document* to Content*.

3) Removed VersionsSupported and OperationsSupported since these are dependent on the interface used in specific solutions.

6/17/02 PJZ Added high level description of PWG Action semantics and Printer state transitions. Returned VersionsSupported and OperationsSupported.

8/16/02 PJZ Changed Content back to document, Added PWG5100.1, PWG5100.2, PWG5100.3, PWG5100.4, job-progress to model. Filled out document object, added "Job Level" subcategory to Processing attributes

9/1/02 PJZ Changes from email input and PWG meeting. Printer/Job/Document Attribute groups broken out into State and Description groups

9/9/02 PJZ Final edits to ready document for review. Updated all figures and added highlighting of sections to review.

9/16/02 PJZ Added more definitions and document actions. Incorporated the comments from teleconference and TH mail note. Updated references.

9/27/02 TNH Version 0.11: Spell checked, corrected some misspelled attribute names,. Finished moving Compression and DocumentFormat from the Processing to the Document Description tables. Improved the attributes descriptions, especially those that are related to other attributes. Added the attributes and values from [prod-print2]. Added several attributes from IPP documents that were missing for some reason. Corrected a number of Maxlength values. Sorted the values of JobStateReasons, DocumentStateReasons, and PrinterStateReasons, so easier to keep track of. Add References: [adm-ops], [prod-print2].

9/30/02 PJZ Began conversion of status string section to table. Corrected and updated figures. Removed detailed IPP encoding section. Added globalization section

10/07/02 PJZ Updated references. Added JobCoverFront, JobCoverBack, and natural language elements. Reworked section 5.3.5 GetPrinterSettableAttributeValues. Corrected Action table and section.

10/14/01 TNH Fixed some Figure caption problems. Instead of deprecating AttributeFidelity, made it work with JobMandatoryAttributes. Added way to specify the member attribute in a collection attribute (Attr.Member). Clarified PagesPerSubset as combining all Input Documents into a single contiguous Input-Pages stream and then subsetting it into Output Documents. Added GeneratedNaturalLanguageSupported from RFC 2911.

10/28/02 PJZ "XML"ified attributes and object & added IPP mapping information describing change. Completed adding [admin-ops], [PWG5100.1]. Rationalized "Pages" and "PageRanges". Changed "State" groups to "Status" to avoid name collision with "State" elements (e.g. "JobState")

11/1/02 PJZ Fixed up status code tables. The DocumentProcessing subgroups were merged into the DocumentProcessing element. Moved fidelity elements to JobDescription. Finished incorporating Prod-Print2 and rfc3381 elements. Cross checked figures tables and associated schema. Added –actuals extension.

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PWG Semantic Model Web Page: http://www.pwg.org/sm/
PWG Semantic Model Mailing List: sm@pwg.org

To subscribe to the sm mailing list, send the following email:
1) send it to majordomo@pwg.org

2) leave the subject line blank
3) put the following two lines in the message body:

```
subscribe sm
end
```

Implementers of this specification document are encouraged to join IPP Mailing List in order to participate in any discussions of clarification issues and review of registration proposals for additional attributes and values.

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11 Appendix A – UPnP Definitions

11.1 DeviceID

The value of this variable MUST exactly match the IEEE 1284-2000 Device ID string, except the length field MUST not be specified.. The value is assigned by the Printer vendor and MUST NOT be localized by the Print Service.

The IEEE 1284-2000 Device ID is a length field followed by a case-sensitive string of ASCII characters defining peripheral characteristics and/or capabilities. For the purposes of this specification, the length bytes MUST NOT be included. The Device ID sequence is composed of a series of keys and values of the form:

```
key: value {,value} repeated for each key
```

As indicated, each key will have one value, and MAY have more than one value. The minimum necessary keys (case-sensitive) are MANUFACTURER, COMMAND SET, and MODEL. (These keys MAY be abbreviated as MFG, CMD, and MDL respectively.) Each implementation MUST supply these three keys and possibly additional ones as well. Each key (and each value) is a string of characters. Any characters except colon (:), comma (,), and semi-colon (;) MAY be included as part of the key (or value) string. Any leading or trailing white space (SPACE[x'20'], TAB[x'09'], VTAB[x'0B'], CR[x'0D'], NL[x'0A'], or FF[x'0C']) in the string is ignored by the parsing program (but is still counted as part of the overall length of the sequence).

An example ID String, showing optional comment and active command set keys and their associated values (the text is actually all on one line):

```
MANUFACTURER:ACME Manufacturing;
COMMAND SET:PCL,PJL,PS,XHTML-Print+xml;
```

MODEL:LaserBeam 9;

```
COMMENT:Anything you like;
ACTIVE COMMAND SET:PCL;
```

(See IEEE 1284-2000 clause 7.6)

Note: One of the purposes of the DeviceId variable is to select a printer driver for those clients that need a printer driver. The values of the COMMAND SET key are interpreted by the printer driver provided by the vendor and so are vendor-defined, rather than being standardized.

12 Appendix B – IPP Mapping

12.1 Changes to remove some IPP specific aspects

This section lists some changes to remove some IPP specific aspects from the PWG Semantic Model.

1. IPP enumerations use their well-known string name instead of the integer enumeration. This applies not only to IPP attributes but also to IPP Operations.
2. Any attribute name containing “ipp” has had the “ipp” removed.
3. All attribute and operation keywords have the substring “attribute” replaced with “element”.
4. All operation and attribute keyword names have had the first letter capitalized and the ‘-‘ character removed and the character following the ‘-‘ has been capitalized. (All mixed case PWG Semantic Model keywords can be interpreted without regard to case.)
5. The attribute value keywords defined remain unchanged and are all lower case, except for the ones that specify other attributes names (which are changed to be the mixed case without hyphens).
6. The types of the attributes have been simplified. All keyword, text, name, DateTime, uri, UriScheme, enum and mimeMediaType types are represented by the simple string type.
7. The “1setOf X” types are represented as the base type and the “Multivalued” field in the tables set to “Yes”. Integers and Boolean types remain the same. Any applicable constraints placed on the attribute values has been noted in the tables.

The term “keyword” continues to be used for string values enumerated as part of the PWG Model. The term “object” is sometimes changed to “data class”. The term “operation” has been changed to “action” to use the term more frequently used with XML.

The following IPP attributes are not included: operation-id, attributes-charset, , page-overrides, request-id, version-number

12.2 Attribute Group Mapping

IPP Actions may contain a number of parameters. The first parameter is always the Operation Attributes for the Action. The IPP Operation Attributes have been mapped to the Printer and Job Description Element Groups.

819 The IPP Printer Description Attributes map to the PWG Printer Status Elements and Printer
820 Description Elements. The IPP Job Description Attributes map to the PWG Job Status Elements
821 and Job Description Elements.

822 The IPP Job Template Attributes map to the PWG Job Processing Elements and Document
823 Processing Elements. IPP does not differentiate between the PWG Processing Elements subgroups
824 of Rendering, Imposition and Finishing Elements.

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