1. Introduction
   1. Scope

This document specifies the attributes of the PWG Semantic Model of an Imaging System and for the Imaging Services provided, including Print, Copy, Scan, FaxIn, FaxOut, and Transform. The System Control Service, providing access to the elements of the System itself, is also discussed. Included in this document is the Service specific terminology, data model, the theory of operation, the Service interfaces and the conformance requirements for a PWG Imaging System and each covered Imaging Service. The abstract model includes the functional models and interfaces of the associated Services for a local network, a cloud, or an enterprise-connected Imaging System.

This specification is an update and extension of the general model presented in the Imaging System Model and Common Semantics Specification [PWG 5108.01-2011].

The purpose of the model is to fully describe, in an abstract context, the Service characteristics as observed from the outside. It is not intended to describe how the Imaging System is implemented internally, and it is expected that different implementations may use vastly different internal architectures. The model defines semantics only for Elements that are accessible or about which information is somehow accessible via an interface defined in the model. The model does not define a protocol or protocol specific encoding by which this access is achieved.

For purposes of this modeling, the Imaging Services that may be performed by an Imaging System are:

* Print
* Scan
* Copy
* FaxIn
* FaxOut
* Transform
* Resource

Note that Email-In and EmailOut, which was treated as services in the Imaging System Model and Common Semantics Specification [PWG 5108.01-2011], have been dropped. The details of the Resource Service, which is used exclusively by the other Imaging System Services, is described elsewhere.

This Document defines:

1. The overall Imaging System model including the terminology and concepts used in the modeling of Imaging Services.
2. The general model of an Imaging Service, a Job and a Document
3. The specific model of each Job-processing Imaging Service, indicating how it relates to and deviates from the general Imaging Service model, including the specific interfaces, operations, and factors unique to each Service
   1. Background

Office imaging functions were once limited to copying, formed letter Printing and primitive telephone-line based facsimile, each performed by a different device. Impact Printers gave way to high quality image Printers with complex interpreters and network communication. Optical copying devices were replaced by digital scanners driving image Printers. Facsimile matured to wed the digital scanners and image Printers with more complex encoding and transports. From the viewpoints of utility, functionality and efficiency, it made sense to integrate these imaging services in a multifunction device.

Although there was increasing commonality in technology, there were very different cultures supporting the manufacture, marketing and maintenance of the different office imaging functions. Slowly, copy and fax functions started appearing in Printers; Print functionality was added to copiers; and facsimile machines had copy functionality added. Eventually, manufacturers supplied equipment specifically designed to address multiple imaging functions. Utilization of the networking, the massive storage, and the internet capabilities that were brought to the office and home environments allowed further expansion of imaging device functionality and has made the Multifunction Device (MFD) the primary hardcopy imaging equipment in enterprise and SOHO environments.

Despite the commonality of technology and the related functionality, the terminology, method of use, and anticipated user interaction of the office imaging functions has been tied to the different cultures associated with these functions and has been slow to coalesce. The PWG MFD Semantics effort [PWG 5108.01-2011] defined an MFD model with consistent semantics for capabilities, configuration, operations and states for each of the Imaging Services.

The deployment of faster and more widely available Internet communication facilities, the trend toward 'Cloud' based computing and data storage, and the prevalence of mobile terminals in the form of smart-phones and tablets using cellular networks has had a further effect on Imaging Services. Services available to Users might not be provided by a MFD on the same local network but by a distributed set of Imaging Systems located in multiple devices and in multiple locations. PWG Imaging Systems Semantic Model V3.0 expands PWG Semantic Model v2.0 to apply to this environment.

1. Terminology

This specification uses some new terms and some common terms used in a specific way for this modeling. For convenience, the following table lists these 'defined' terms with a summary definition. Defined terms in the text have their initial letters capitalized. The definitions may vary somewhat from those in the Imaging System Model and Common Semantics Specification [PWG 5108.01-2011] which was MFD oriented.

Multi-word defined terms are presented in this table with normal spacing between words. However, in some places in this specification the term may be referring to a specific XML Element in an XML Schema. In that case, the spaces between words are omitted in accord with the XML Element tag. In either case, the definition of the term is the same.

* 1. Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in RFC 2119 [RFC2119].

* 1. Other Terminology

The definitions below contain common definitions for Service qualified terms. The term ‘<service>’ in any of the definitions below should be taken to be the name of the specific Service being considered (i.e., ‘Copy”, ‘FaxIn’, ‘FaxOut’, ‘ Print’, ‘Scan’, ‘Transform’ or ‘System Control’) when the term is used in referring to the individual Service.

Table PWG Semantic Model Terminology

| Term | Definition |
| --- | --- |
| <service> | An identification of the specific Imaging Service involved, sometimes preceding (and sometimes embedded in) terms dealing with Devices, Clients, Jobs and Job Elements, Documents and Document Elements (e.g., Print Document Ticket, Scan Intent, FaxIn Job.) See definition of Service. |
| Active Jobs | A Service instance specific queue containing all the Jobs that are waiting to be processed or are currently processing. |
| Automatic Document Feeder (ADF) | A mechanism for handling Hard Copy Documents for scanning. The mechanism selects a media sheet from its bin and passes it to the image acquisition subsystem of the Scan Device. After the Scan is complete the ADF transports the Hardcopy Document’s media sheet to its final destination (e.g., output bin, ADF bin.) |
| Capabilities | Used in the context of <service> Capabilities, this term refers to those Elements of a Service that can be used in the processing or description of a Job or Document. The models include Job Processing Capabilities, Job Description Capabilities and Document Processing Capabilities. Generally, a Service must be able to report its Capabilities and Job Tickets may include the desired values of these Capabilities Elements to describe the User’s Intent. |
| Client | The local or remote software entity that interfaces with the Job Originator and interacts with an Imaging Service. |
| Content Region | The area of a Hardcopy Document or Digital Document which is to be processed by an Imaging Service. Content Regions are applicable to Scan, FaxOut, Copy and, to an extent, Print Services. For example, a Scan Content Region is the portion of a Hardcopy Document media sheet side to be scanned and converted into a Digital Document. A Copy Content Region is the portion of a Hardcopy Document media sheet side to be printed. Depending upon the Service and the implementation, there can be multiple Content Regions defined for a given media sheet side. |
| Cross Feed direction | The direction perpendicular to the movement of the Hard Copy Document or the direction that the print head or scanner light bar moves. For scanners that use a technology other that a light bar, this is the direction along which the image data is acquired most quickly. (Also called Fast Scan direction, X) This direction is sometimes referred to as X Feed direction. |
| Default Job Ticket, Default <service>Job Ticket | A Job Ticket data object that is bound to an instance of an Imaging Service. The Job Ticket Default <service>Job Ticket values are used by the Imaging Service when the Job Ticket for Job being processed does not specify a different value. |
| Destination | The end point network address of a storage location for a Digital Document output from a Service. |
| Destination URI | A URI that specifies the recipient of a Digital Document transmission for FaxOut or EmailOut services. It may also contain the URI for the routing to the recipient. |
|  |  |
| Digital Document | A Document in digitally encoded form as distinguished from a Hardcopy Document. The data input to or output from a Service containing the electronic representation a Hardcopy Document. The Digital Document may also include metadata relative to the Document. Digital Documents are the primary input to Print, FaxOut, EmailOut and Transform Services and the primary output from Scan, FaxIn, EmailIn and Transform services. The Print, EmailOut and FaxOut Services may also have a secondary Digital Document output. See Hardcopy Document. |
| Directory Service | A software application or a set of applications that stores and organizes information about a computer network’s users and resources, and that allows network administrators to manage user’s accesses to the resources. |
| Discovery Client | A software application that performs service or resource discovery on a computer network. |
| Document | An object created and managed by an Imaging Service that contains the description, processing, and status information of a data object submitted by a User. A Document object is bound to a single Job. |
| Document Data | The digitized data submitted by a Job Originator as the Document or portion of a Document to be processed by an Imaging Service, or as the data resulting from the scanning of Hardcopy Document(s) in an Imaging System. The images from the scanned Hardcopy Document(s) are encoded in a specified format and stored at a Destination. |
| Document Repository | A local or remote data store where Digital Documents are stored by or recovered from an Imaging Service |
| Document Resource | A Resource associated with a Document within a Job of an Imaging Service is a Document Resource. |
| Document Ticket | A data object that contains a User’s <service>Intent for Document processing and descriptive properties of a Document in a Job. Any Document processing properties in the Document Ticket for a particular Job will override the values specified in the Job Ticket’s Document processing properties. The content of a Document Ticket is configured by a User through a <service> Client. |
| Element | A term used to convey structure and relationships in XML Document instances. An Element can contain both content and Elements. Complex Elements are composed, at least in part, of other Elements. |
| End User | A User (Administrator, Job Owner, Operator, member of the Owner's group or other authenticated entity) for whom the Job output is intended. |
| Executable Resource | Executable code that is installed in an Imaging System and executed for performing a task. Executable Resource includes two types of resources: Firmware, and Software. (See Firmware, Software definitions below.) Executable resource is a category of resources that is served by the Resource Service. |
| Fast Scan direction | Same as Cross Feed direction or X. |
| Feed direction | The direction along which the physical medium is moved or the direction that the print head or scanner light bar moves relative to the Hard copy Document. For scanners that use a technology other that a light bar this is the direction along which the image data is acquired most slowly. (Also called Slow Scan direction or Y) |
| Firmware | Persistent computer instructions and data embedded in an Imaging System that perform the basic functions of supported Imaging Services. Firmware is only replaced during a specialized update process. [IEEE2600] Firmware is a type of resource that can be retrieved and stored by PWG Resource Services. |
| Font | A complete character set of a single size and style of a particular typeface. Most current computer fonts are based on fully scalable outlines. However, the term “Font” still refers to a single style. Times New Roman regular, italic, bold and bold italic are four fonts, but one typeface. Font is a type of resource that can be retrieved and stored by a Resource Service. |
| Form | A Document (printed or electronic) with spaces in which to write or enter data. Used in the context of the this specification, the term “Form” refers to an electronic form, which is a type of resource that can be retrieved and stored by PWG Resource Services. |
| Group Element | A collection of Elements that constitutes a complex Element. |
| Hardcopy Document | A Document on physical media such as paper, transparency or film that is the input source to Scan, Copy and FaxOut Services and the output from Print, Copy and FaxIn Services. |
| ICC Profile | A set of data that characterizes a color input or output device, or a color space, according to standards promulgated by the International Color Consortium (ICC). Profiles describe the color Elements of a particular device or viewing requirement by defining a mapping between the device source or target color space and a profile connection space (PCS) (see definition below). This PCS is either CIELAB or CIEXYZ. Mappings may be specified using tables, to which interpolation is applied, or through a series of parameters for transformations. Every device that captures or displays color can have its own profile. ICC profile is a type of resource that can be retrieved and stored by a PWG Resource Service. |
| Image | A digital electronic representation of the information captured by a Scan Device. One Image is produced as a result of a Scan Device scanning a Scan Region. One or more images are contained in the Digital Document produced by a Scan Service. |
| Imaging Client | A Client interacting or seeking to interact with an Imaging Service. |
| Imaging Device  <service> Device | An abstract object representing a hardware component that implements one or more Imaging Services. The term may be preceded with the name of the specific Imaging Service (represented here by <service>). A Device exposes every Subunit on the associated host system involved in performing the functions of the indicated Imaging Service. For example a Print Device or a Scan Device. An Imaging Device or <service> Device Imaging Device always contains an Imaging System. Note that the word "device" is NOT a defined term in this specification and is used in its normal in the typical English language sense of an object, machine, or piece of equipment that has been made for some special purpose. |
| Imaging Service | A Service that accepts and processes requests to create, monitor and manage Jobs, or to directly support other Imaging Services in an imaging-specific way (i.e., the Resource Service). The Imaging Service accepts and processes requests to monitor and control the status of the Service itself and its associated Resources. A Service is part of an Imaging System. |
| Imaging System,  System | The object with which interaction (via the System Control Service) needs to be with the group of Services as an entity rather than with a specific Service. The System is modeled to include all of the Subunits used to implement the System Services, as well as identification and overall status. An Imaging Device always contains an Imaging System, but an Imaging System might be implemented in multiple hardware devices or hosted on a general purpose application server that also hosts other unrelated applications. |
| Intent | The User’s preferences for the processing and description properties of a Job or Document. |
| Job | A data object, created and managed by a Service, that contains the description, processing, and status information of a Job submitted by a User. The Job can contain one or more Document objects. |
| Job History | An Imaging Service instance specific queue containing all the <service>Jobs that have reached a terminating state. The terminating states are defined as Completed, Aborted and Canceled. The length of this queue is determined by the implementer. The Jobs should remain in the Job History for a time sufficient for interested parties to obtain information on completed Jobs. |
| Job Originator | The User that submits the initial request to create the Job. |
| Job Owner (or Owner) | Normally the User who submits a Job is the Job Owner, although under certain circumstances an administrator can reassign ownership. The Job owner has certain administrative privileges with respect to his Jobs. |
| Job Receipt | An Element of the Service that contains information on the actual values of processing Elements used by the Service for processing a Job. The content of a Job Receipt is populated by the Service when a Job is processed. |
| Job Resource | A Resource associated with a Job. |
| Job Template | A Job Ticket data object representing a User’s preconfigured Intent that is not bound to a specific Service or Job. |
| Job Ticket | A data object that contains a User’s Job-level Intent for Document processing, Job processing and descriptive Job properties of a Job, sent to an Imaging Service. Job Elements apply to the entire Job. Document processing Elements apply to all Documents within the Job unless overridden at the Document level (See Document Ticket). The content of a Job Ticket is configured by a User through a Client. |
| Local Client  Local <service> Client | A software application entity that is co-located with and Imaging Service and interacts on behalf of a User. |
| Logo | A graphical Element, (ideogram, symbol, emblem, icon, sign) that, together with its logotype (a uniquely set and arranged typeface) form a trademark or commercial brand. Logo is a type of resource that can be retrieved and stored by a PWG Resource Service. |
| Multifunction Device (MFD) | A hardware entity that supports one or more Imaging Services, including the System. Generally abbreviated MFD, this also includes Imaging Devices commonly called Multifunction Peripherals or Multifunction Printers (MFPs) and All-In-Ones. |
| Physical Document Ticket,  Physical <service>Document Ticket | A printed, encoded Document Ticket submitted by the Job Originator with the Hardcopy Document to be scanned, which becomes a Document Ticket data object after being scanned and processed. This may be used for Scan, Copy and Fax-Out Services. |
| Physical Job Ticket,  Physical <service>Job Ticket | A printed encoded Job Ticket, submitted by the Job Originator with the Hardcopy Document to be scanned, that becomes a Job Ticket data object after being scanned and processed. This may be used for Scan, Copy and Fax-Out Services. |
| Profile Connection Space (PCS) | A standard device independent color space defined by the International Color Consortium (ICC) that is used for mapping the color space of one device to the color space of another by describing the relationship of each device’s color space to this device independent color space. |
| Region | A rectangular area of a Digital Document that has been specified by an Administrator or End User as the bounding area for which a digital data representation will be output; or a rectangular area of a Hardcopy Document that has been specified by an Administrator or End User to be generated from a Digital Document |
| Remote Client | The Remote Client is a Client external to the Imaging System that interfaces with the End User and interacts with a Service. |
| Resource | A data object that can be served by the Resource Service when required by an Imaging Service for performing a task or a Job. There are two categories of Resources: Executable Resource, and Static Resources. (See the definitions of Executable Resource and Static Resource). |
| Resource Client | The local or remote software entity that interfaces with the User configuring the Resource Service and interacts with a Resource Service. |
| Resource Service | A software service that provides the interfaces for storing, retrieving, and maintaining Users’ Resources. |
| Retained Job | A Retained Job is one which remains in the Service after it has been completed or canceled. This retention may be incidental or because the Job, is a Saved Job. A Retained Job is the only type of Job that can be referenced in a Resubmit Job operation. |
| Saved Job | A Completed or Canceled Job with a “JobSaveDispostion” Element value indicating that the Job, including Document Data if any, should not be deleted or aged-out after the Job is completed. |
| Sequence | A type of XML structure that represents an ordered list of Elements. |
| Service | An Imaging System service, in the sense of Client-Server model, including the System Control Service and the Imaging Services. |
| Slow Scan direction | Same as Feed Direction or Y direction. |
| Software | Persistent computer instructions and data placed on an Imaging Device (such as an MFD) via download, that are separate from, and not a part of, the base Firmware. Software supports features or applications that are in addition to those provided by the base Firmware. Software is a type of Executable Resource. Software is a type of resource that can be retrieved and stored by a PWG Resource Service. |
| Static Resource | A non-executable electronic data object that is required by an Imaging system for performing a task. Static Resources include the following types of resources: Font, Form, Images, Logo, and Template. |
| Subunit | A physical entity contained within or controlled by an Imaging Device that performs a specific process necessary to support one or more Imaging Services; (e.g., Marker, Console, Covers, Interfaces, Input Channels, Output Channels, etc). Note that, for historical reasons, the term Scanner may refer to either a Subunit or a Scan Device. |
| System | See Imaging System. |
| Template | A data object that contains descriptive information and the pre-configured content of a Job or Document Ticket for a specific Imaging Service. A Template is not bound to a specific Job or Document. It can be stored or retrieved from a Resource Service, collocated on the Imaging System or hosted on a remote system. Template is a type of Resource that can be retrieved and stored by a PWG Resource Service. |
| User | Users include the Administrators, Job Owners, Operators, members of the Job Owner's group and other authenticated entities. |
| Watermark | A recognizable image or pattern when printed on paper used to identify authenticity. Watermark is a type of resource that can be retrieved and stored by a PWG Resource Service. |
| X | An axis of the coordinate system. This axis is associated with the Fast Scan direction of the Scan Device. If the light bar or Hard Copy Document moves, they do not move in the X direction. They move in the Y direction. (See also Cross Feed direction, Fast Scan direction) |
| Y | An axis of the coordinate system. This axis is associated with the slow scan direction of the Scan Device. If the light bar or Hard Copy Document moves, they move in Y direction. (See also Feed direction, Slow Scan direction) |

* 1. Acronyms and Organizations

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

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

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

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

1. Requirements
   1. Rationale

Office imaging functions were once limited to copying, formed letter-printing and PSTN facsimile, each performed by a different device. Impact Printers gave way to high quality image printers with complex interpreters and network communication. Optical copying devices were replaced by digital scanners driving image Printers. Facsimile matured to wed digital scanners and image Printers with more complex encoding and transports. From the viewpoints of utility, functionality and efficiency, it made sense to integrate these Imaging Services in a Multifunction Device. The wider access to data and the mobility of Users provided by the Internet and a plethora of access devices has prompted an abstraction of the PWG Model from an MFD to an Imaging System. An Imaging System may be contained within a Imaging Device; it may be a distributed system spread over several devices; or it may be implemented by software in general purposed devices with connections to hardcopy input and output devices.

A consistent semantic model of Imaging System Services allows Users to be provided with similar capabilities and interfaces whether they are communicating from a smart-phone, a computer console or something in between. The model is also useful to equipment manufacturers and software providers to allow a more efficient implementation of the devices and the use of a more standard set of drivers.

Considering this situation, this specification describes a PWG Semantic Imaging System model (formally defined in the Semantic Model 3 schema) to provide a set of abstract operations and Elements commensurate with current and anticipated future usage.

* 1. Use Cases

Imaging Services have been provided for many years and most are well defined in practice. Semantic Model 1 [PWG 5105.1-2004] used IPP [RFC2911]operations and attributes as the basis for a Print Service model. Semantic Model 2 [PWG 5108.01-2011] applied Semantic Model 1 to model other Imaging Services, adding additional operations and elements and the concept of a multi function Imaging System. Semantic Model 3:

1. Refines the individual models of Imaging Services' models
2. Expands Semantic Model 2 to address the elements and interfaces of distributed Imaging Systems necessary to support mobile and cloud based imaging applications.
3. Considers aspects of the Imaging System Model necessary to allow multiple Imaging Services to orchestrated.

Therefore, the Use Cases presented here are concerned more with how Imaging Services are invoked than the specifics of Printing, Scanning, Copying, etc. This specification builds upon the commonality of terms and interfaces presented in Semantic Model 2.0 [PWG 5108.01-2011] to address the modeling of Imaging Services in a Mobile and Cloud as well as conventional Local Area Network environment.

* + 1. Transform Service Use Case

The basic functionality of scanning/ printing/faxing/copying is well established. However, although the Transform Service can be used directly by a Job Originator, it is usually employed to support other Imaging Services. Therefore, use of the Imaging Service may require Imaging System to Imaging System communication. Indeed, the Service may not even be visible to the User. Specific Use Cases for the Transform Service are therefore presented.

* + - 1. Transform Service
      2. Transform Service in Cloud Imaging Envroment

The Job Originator sends a document formatted in Apple Pages™ to a local Print Device. This Device does not handle Apple Pages format directly but does have access to a Cloud Imaging System with a Transform Service that does accept Pages format and converts it into a format suitable for printing on that Print Device.

The Print Device sends the document to the Cloud Transform Service and the Transform Service returns the document in the desired format to the Print Device which prints the document for the Job Originator..

* + 1. Imaging Service Use Scenarios

The following scenarios deal with extended functionality of an Imaging System and the interaction of Services sharing common subunits. These scenarios are not intended to cover all ways in which the Imaging Services would be used.

* + - 1. Use Case 1: Create Job Template from a Remote Network Client Application

Imaging Services are often used in recurring ways: e.g., Printing company memos in a particular format; sending out orders via Facsimile; scanning accident reports and storing in a repository. Job Templates simplify these actions by providing the recurring parameters for Job Tickets.

Scan Template Example

Nancy, working in the human resource department, is conducting an “anonymous” employee survey. To preclude apprehensions of electronic input being traced, the survey sheets are provided in Hardcopy form. The completed forms must to be scanned and processed to analyze the survey results. Nancy wants to use the group Imaging System to Scan then store the scanned survey forms in the survey project directory. However, she does not want to set up the Job parameters for each filled-in form as the forms filter in. Therefore Nancy launches her Imaging Service Client application and requests the creation of a new Job Template. Nancy sets up her Job Template with her intent and the repository location for the Documents associated with this new activity. Finally, Nancy requests that her Job Template be stored on the group Imaging System under her account. Nancy closes her Imaging Service Client application.

Print Template Example

Joe, manager of a sales department, has dictated that internal memos must be distributed on recycled paper and, if more than one page, must be printed in duplex. He is tired of employees saying that they don’t know how to do this, or that they forgot. So he wants to set up the Imaging System with a Job Template so that Users need just select “internal memo” and number of copies. Therefore, Joe launches a Job Template Client that allows him to define a Job Template tag and the print parameters to create a Job Template that is to be stored in the Imaging System and that is readily accessible to walk-up Users.

FaxOut Template Example

Dick is a legal aid working on a commercial case that involves a series of contracts, with copies to be delivered via facsimile to a set of recipients. The contracts are generated by several attorneys on their computers and Dick wants a reliable way to ensure that all intended recipients get their copies promptly and in the proper way, and that each record of transmission and successful reception be sent to the proper repository. Dick launches a Job Template Client that asks him to set up the facsimile parameters, the destinations, and the handling of the transmission and reception reports. He sets this up to be stored in a central location so that each attorney can call it up as needed.

Example Processing Steps

Listed below are processing flow requirements for the scenarios.

1. The User invokes a Template generation application.
2. The User may select an Imaging Device to use to constrain their imaging function Intent
3. The User requests the creation of a new Job Template.
4. If the specific Imaging Device has been identified in the User request, the Template generation application may contact the appropriate Service in that Device to request the associated description attributes and the range of values for each attribute of the Service (i.e., the Capabilities).
5. The Template generation application presents the Job Template to the User.
6. The User modifies the Job Template attributes to meet their specific Intent.
7. The Template generation application validates the modified Job Template.
8. The User designates storage of the modified Job Template to be at the specified Resource Service.
9. The Template generation application requests the Resource Service to store the modified Job Template on behalf of the specified User(s).
10. The Resource Service stores the modified Job Template.
11. The Template generation application informs the User that their modified Job Template has been stored.
12. The User exits the Template generation application.
    * + 1. Use Case 2: Handling Multiple Hardcopy Documents from a Computer

After the Hardcopy Document is placed on the platen or in the ADF of a Scanner Subunit, a User is to control scanning operations using the remote Imaging Service Client from the User’s desktop computer. The User continues to place the next set of Hardcopy originals on the scanner subunit when requested, and repeats the process until all sets of the User’s Hardcopy Documents have been scanned and processed according to the specified Intent. This use case can apply to all Imaging Services that use the Scanner Subunit.

Service Examples

Clara has to Scan, Copy, or FaxOut a multipage Document in a busy office environment. Every time she goes up to the Imaging System, either someone else is standing there or the machine is busy processing some long Job. Clara does not have the time to stand there and wait for the machine to become available and then spend time setting up her Job Ticket. She needs to be able to set up the proper Job Ticket from her workstation, get a notice from the Imaging System when the Service she needs is available. She can then go to the machine, load her original, identify her Job Ticket and start the Job. Also, since her Job is very large, she will need to reload the ADF several times. She does not want to wait by the Imaging System, but needs a notice from the Imaging System when more input must be loaded.

Example Processing Steps

The following are the processing steps for this scenario.

1. From the Resource Service Client application on their computer, the User obtains a local copy of the Job Template to use for their Intent.
2. The Imaging Service Client modifies the local copy of the Job Template to the user’s Intent for use as a Job Ticket. This modification may include noting the Job includes multiple Documents with the same or different destinations.
3. The Imaging Service Client application sends a Create Job operation including the Job Ticket to the Service.
4. The creates a Job but puts the Job into a ‘Hold’ state (inhibiting scheduling).
5. The Imaging Service Client application is monitoring the Job and the state of the Imaging Device. It notifies the User of the Job Identification and notifies the User when the Imaging Device is free.
6. When the Imaging Device is free and the User is ready, the User comes to the Device, identifies their Job and requests that it be released from the ‘Hold” state. The Service schedules and begins to process the Job.
7. The Service requests the User to place the Hardcopy Document(s) in the Automatic Document Feeder.
8. The User provides the Document and presses the "Continue" button on the Imaging System.
9. The Service scans the individual pages of the Hardcopy Document. If the entire Document has not been placed on the Imaging System's ADF, the Service detects that more Hardcopy must be inserted and requests the User to put in the next sheet(s).
10. The User presses the "Stop" button when all of the Hardcopy Document's pages have been scanned.
11. The Service processes and delivers the Digital Document according to the nature of the Service and the Job Ticket instructions.
12. Repeat Steps 9 through 13 until the last Document is complete.
13. The User presses the "Stop" button to indicate that there are no more Documents for this Job.
14. The notifies the Service Client application on the User’s computer that the Job is complete based on the information in the Job Ticket.
    * + 1. Use Case 3: Walk-Up Batch-Scanned Input

This scenario can apply to any Imaging Service using the Scanner Subunit with an Automatic Document Feeder, although the Document boundaries may be lost with the FaxOut Service.

Service Example

Glen needs to Scan a stack of Hardcopy Documents. For each Document to be scanned, Glen prepares a Physical Document Ticket and places it in front of the corresponding Document. Glen then prepares a Physical Job Ticket and places it in front of the stack and places the stack in the Imaging System’s Automatic Document Feeder. Glen selects “batched” and presses the green button.

Example Processing Steps

The following are the processing steps for this scenario.

1. Glen places the stack of Hardcopy Documents on the ADF.
2. From the Local Client, Glen selects the “batch” mode of the Service.
3. The Local Client requests the Service to switch to “batch” mode.
4. Glen pushes the Start button.
5. The Local Client requests the Service to start “batch mode” operation.
6. The Service creates a “batch mode” Job.
7. The Service creates a Job Ticket from the Job Ticket Default Job Ticket.
8. The Service schedules the Job.
9. The Service executes the Job.
10. The Service scans the first sheet, recognizes it as a Physical Job Ticket and modifies the Job Ticket based on the information obtained from the digital image data of the Physical Job Ticket.
11. The Service scans the sheet at the start of the first Document and recognizes it as Physical Document Ticket.
12. The Service creates a Document within the Job, creates and fills in the Document Ticket based on the information obtained from the digital image data of the physical Document Ticket.
13. The Service scans the Hardcopy Document and stores the Digital Document at the specified Destination until the end of the Document is detected.
14. If another Physical Document Ticket is detected, the Service creates another Document within the Job, creates and fills in the Document Ticket based on the information obtained from the digital image data of the Physical Document Ticket.
15. Return to Step 13 until the scanning of all Documents in the Job, as identified on the Job Ticket, has been competed.
16. The Service completes processing of the scanned information and notifies the Local Client that the Job is complete.
17. The Local Client notifies the User that the Job is complete based on the information in the Job Ticket.
    * + 1. Use Case 4: Pause Service for Pre-emptive use of Subunits

Some Imaging Services have traditionally allowed a Job to be paused to allow a higher priority Job to go to completion. Because Services share subunits in an Imaging System, this pause capability must be extended to pausing a Service so that a different Service with a higher priority Job can use a common subunit. The following examples show how this may apply.

Pausing Scan Service

Anne urgently needs to Copy a few Documents while a long Scan Job is running. Since she has administrative rights, she pauses the Scan Service until she has copied her Documents and then resumes the Scan Service (which resumes the Job previously in progress).

Pausing Print Service

Joan needs to Scan some critical Documents but the Imaging System is tied up with a long Print Job. As the president’s executive assistant, Joan has admin rights. She pauses the Print Service and gives her Scan Job highest priority. Of course, she must remember to unpause the Print Service when she is done.

Processing Steps

The following processing flow steps apply to this use case:

1. The User walks up to the Imaging System with a Job and sees the Imaging Device engaged in a Service using the same subunit that they need. Using the Local Client, they bring up the Service configuration menu for the currently active Service and request that that Service Pause.
2. The Local Client requests that the currently active Service pause and the Service performs a ‘pause’ operation.
3. The Service notifies the Client the ‘paused’ status.
4. The User removes any sheets from the ADF and from the output bin and puts the Hardcopy Documents on the platen or the ADF.
5. The User initiates a Job for their Documents. Since no specific Job Ticket information is added, the Service uses the Job Ticket Default Job Ticket.
6. After the User’s Job is complete, the User removes their originals and any copies, restores the previous Documents to the scanner subunit and brings up the Service configuration menu from the console to resume the paused Service.
7. The Local Client requests the paused Service to resume and that Service performs a ‘resume’ operation.
8. The resumed Service notifies the Local Client of the ‘resumed’ status.
   * + 1. Use Case 5: Service Discovery

This scenario applies to all Imaging Services. Bill wants to discover the Services available in his enterprise network, so that he knows what he can choose in the future when he wants to submit a Job. Bill wants to discover Services both statically (via enterprise directories) and dynamically (via discovery protocols).

Processing Steps

For static discovery via a directory service, the following flow step requirements are identified:

1. At start-up, each Service authenticates with and connects (binds) to the Directory Service of the network domain of the Imaging System, then registers the Service information with the Directory Service.
2. At any time, a Discovery Client sends the Directory Service a “lookup” search request for the specific Service type in order to locate a Service.
3. The Directory Service returns an appropriate list of Services.

For dynamic discovery via a Service discovery protocol, the following processing requirements are identified:

1. At start-up, each Service announces its Service type and location to the multicast group in which all Services and discovery clients reside. Any listening Discovery Client will detect newly-available Services automatically.
2. To initiate a discovery at any time, a Discovery Client sends a “search-by-service-type” query to this multicast group.
3. Each Service responds to a search query with a “service-type-matched” message.
4. In a network environment where a discovery proxy server is preferred, the proxy server listens to this multicast group for Service announcements from all Services and announces its Service in response to each search query received.
5. If a discovery proxy server is preferred, the Client sends a “search-by-type” message to this proxy server to discover all available Services.
6. The discovery proxy server returns the list of Services that match the specific Service type to the client.
   * + 1. Use Case 6: Service Capability Discovery

An Imaging System is setup on the network. The Imaging System has been previously discovered and is known to the application software that will query the Imaging Device for capabilities. Ira wants to learn if the capabilities of various Services, such as whether the Scan Service is capable of sending his Document as a PDF file to his mailbox. He would also like to know if the Print Service is capable of duplex operation and whether the FaxOut Service accepts Digital Data input coded in PDF. From the application on his computer, Ira is able to select options available knowing that the application has determined what the capabilities of the Services are and that the indicated options will be supported.

Processing Steps

From the Remote Client at User’s computer, the User selects a target Service and requests the list of capabilities of the Service.

1. The Remote Client requests the Service the list of capabilities of the Service.
2. The Service returns the Service Capabilities to the Remote Client.
3. The Remote Client requests the User interface to display the list of Service Capabilities to the User.
   * + 1. Use Case 7: Cloud Imaging System Interfacing with Imaging Devices

The use of Cloud-based applications and services includes the use of distributed Imaging Systems, with software components in the Cloud interfacing with User Devices (such as computers) and hardcopy devices on local networks. Although these networks typically allow User Client applications to access the Cloud (often with some identification/authentication steps), Cloud system access to imaging devices on a local network is typically restricted by a firewall.

Document Data to Remote Device

The User locates an appropriate Cloud Imaging Service, determines that his document format can be accepted, that it can be printed as he wishes and that the printed document will be available where he wants it. The User may check the status of the Cloud Imaging Service and of the Print Device. He then submits a document for printing. Later he may check the status of his request and ultimately of the printed document..

Scan Document Initiated from Imaging System

The User goes to an Imaging System in a hotel, enters identifying information, inserts the copy to be scanned in the ADF, and selects SCAN from the Imaging System control panel. In response to prompting from the panel, he enters scan parameters and intended destination of the digital image file.

The Imaging System sends the scan request to the Cloud Imaging System which checks that the User is authorized to received the desired service. Provided that he is, the Scan Service in the Cloud Imaging System instructs the Imaging System to scan the original and sends the resulting image file back to the Scan Service. The Scan Service reformats the data as directed and delivers it to the selected destination.

Document Copy Initiated from Tablet

The User's tablet computer has a 'copy app' configured to connect to his company's Cloud Imaging Service and to use the department Imaging System as the imaging device.. The application includes a client that identifies the User and allows the Cloud Imaging Service to impose restrictions on the number of copies and the use of color printing, as well as providing accounting functions. The User requests a copy job indicating number of copies and other parameters such as color and media, assuming they differ from defaults. The Cloud Imaging Service responds with a Job ID. User then goes to the department Imaging System, inserts his originals in the ADF and enters his personal ID and Job ID. Alternatively, The originals are scanned and copies are printed.

* 1. Out of Scope

The following are out of scope for the Semantic Model 3.

1. Specifics related to the security of the Document or administrative information, protection of the communication mechanisms or the implementing Imaging Devices from abuse, or methods of usage accounting. However, the models structure must not inhibit addressing these requirements by other appropriate means.
2. Any semantics related to a specific protocol. Rather, it is intended to make the semantics protocol and transport agnostic.
   1. Design Requirements

Consideration of the Use Cases results in certain common design requirements for the Service models. The following requirements are derived from the considerations and use cases.

The significant considerations to be considered in this Model are:

* Users want Imaging Services to be locatable and accessible via whatever terminal device they are using, from wherever they are. Document handling and processing need to be transparent to the user, no matter how complicated the actual processing may be. Once they have created or selected a Document, they do not want to be concerned with the specifics of how that Document gets printed or faxed or copied; they just want the right people to get it in the right form at the right time. By extending consistent Semantics to all Imaging Services, all Document processing and handing should appear simple and intuitive to Users.
* Administrators and operators want the setup, maintenance and monitoring of devices performing Imaging Services to be capable of supporting the Users’ requirements in an efficient and consistent way across all Services, whether when multiple Services are performed by a one device or many distributed Systems. A consistent modeling must support accounting of Service utilization, ensuring availability of consumables, and handing of problems in capacity, utilization, security issues and equipment malfunction.
* Developers of applications, drivers and user interfaces need to support the user requirements. The developers want a consistent terminology and capability in operations and messages.
* Users, Operators and Administrators need proper security provisions in place, both to protect User's data and to prevent abuse of the Services.
  + 1. Design Requirements from Use Cases

The Use Cases suggest certain requirements of the Service models and of the System model that go beyond having an operational capability analogous to IPP.

* + - 1. System Requirements

An Imaging System potentially supports several Services, and those Services share the Subunits constituting the Imaging System . One Subunit is the Console, with which a User interfaces to request Job creation in any of the Services, as well as to configure and control the individual Services. Therefore, there must be something starting and controlling the Services, managing the access to shared Subunits, and providing overall status and reporting information. That is, the set of Service models must include a System.

* + - 1. Service Requirements

Each Service must accommodate:

1. A consistent Job structure, including a Job Ticket defining the User Intent for the Service to act on the Job Document(s).
2. A Default Job Ticket, to be used when a Job Ticket does not specify the values of all necessary Elements.
3. A Job Template, containing the Elements characteristic of a recurring type of Job, to prevent the User having to make up a full Job ticket in all cases.
4. A repository for storing and recalling prepared Job Templates, with each Service having access to this repository.
   * + 1. Service Related Requirements

In this context, Status refers to characteristics of a Service which are not settable by an administrator. This generally includes capabilities and state. Description refers to Elements which are settable, and includes Elements such as name, and settable parameters. In being able to report Status and Description Elements, each Service shall make this information available, although it may in fact be the System that satisfies some of the requirements below.

1. For supporting dynamic Service discovery, the Service type, Service instance, and endpoint address information must be supplied to the multicast group in which it resides at start-up of the Service.
2. For supporting static Service discovery, an entry record must be sent to a specified Directory Service at Service start-up for registering Service information.
3. In response to a discovery or search query from a Discovery Client, the Service type, Service instance, and endpoint address information must be supplied to the client.
4. A Service must respond to a Client’s query for Service status and descriptive Elements and the range of each descriptive Element. This response must include the capabilities supported by the Service and the default values of descriptive and processing Elements of a Job Ticket.
   * + 1. Document Related Requirements
     1. Basic Operations

The operations in the following table, which are primarily based on those defined for the Printer Service in IPP (REF), are operations reasonably required to be supported in the modeling of Imaging System Services.

Table Imaging System Common Operations

| MDF Service Operation |
| --- |
| AddHardcopyDocument |
| CancelCurrentJob |
| CancelDocument |
| CancelJob |
| CancelJobs |
| CancelMyJobs |
| CloseJob |
| CreateJob |
| DisableService |
| EnableService |
| GetDocumentElements |
| GetDocuments |
| GetJobElements |
| GetJob History |
| GetActiveJobs |
| GetServiceElements |
| GetServiceElements |
| HoldJob |
| HoldNewJobs |
| PauseService |
| PauseServiceAfterCurrentJob |
| PromoteJob |
| ReleaseNewJobs |
| ReleaseJob |
| RestartService |
| ResubmitJob |
| ResumeJob |
| ResumeService |
| PromoteJob |
| SendDocument |
| SendURI |
| SetDocumentElements |
| SetJobElements |
| SetServiceElements |
| ShutdownService |
| StartupService |
| SuspendCurrentJob |

* + 1. Requirements from Common Use of Subunits

An Imaging System includes many subunits, some of which are used by all Services, and some a subset of the supported Services. Indeed, there may be Imaging System implementations that include multiple subunits of a given type. (In use case 4 for example, multiple markers or multiple scanners would prevent the need for having to pause a currently active service.) In modeling the Imaging System Services, all of the Imaging System subunits that might be used by the Service must be identified.