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Cloud Imaging Requirements and Model (IMAGINGMODEL)

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Abstract: This specification outlines the requirements of and defines a model to support imaging services using the Cloud, based on the PWG Semantic Model. The IPP Binding for this model is described in IPP Shared Infrastructure Extensions [PWG5100.18-2015]

This specification is a PWG Candidate Standard. For a definition of a "PWG Candidate Standard", see: <http://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf>.

This specification is available electronically at:

<http://ftp.pwg.org/pub/pwg/candidates/cs-cloudimagingmodel10-20150619-5109.1.docx>

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For additional information regarding the Printer Working Group visit:

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About the Cloud Imaging Work Group

Cloud-based applications and solutions are increasingly common, and Cloud-based printing, scanning, and facsimile (collectively called "Cloud Imaging") are emerging in several different forms. Adopting standard protocols and schemas now will help interoperability, speed adoption, and address privacy, security, and legal issues involved in Cloud Imaging.

For additional information regarding Cloud Imaging visit:

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

Implementers of this specification are encouraged to join the Cloud Imaging mailing list in order to participate in any discussions of the specification. Suggested additions, changes, or clarification to this specification, should be sent to the Cloud Mailing list for consideration.

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1. Introduction

This specification identifies the requirements and presents the model for PWG Cloud Imaging. PWG Cloud Imaging is a method by which a User, outside of the Cloud, uses the Imaging Services of a PWG Semantic Model compatible Imaging System (MFD Model and Common Semantics [PWG5108.01]) within the Cloud, and by which this Cloud Imaging System provides access to Imaging Services in registered Imaging Systems outside of the Cloud on behalf of the User.

The MFD Model and Common Semantics [PWG5108.01] defines the network interface between a User Client and an Imaging Service. This interface is applicable to the User Client to Cloud Imaging Service connection and can be used in any Cloud Imaging application in which the User Client initiates access to a Cloud-resident Imaging Service. To provide for Imaging Service fan-out, this interface also applies to connections between like Imaging Services. However, because of firewalls, this interface cannot be used for connections from a Cloud Imaging Service to Services in an Imaging System outside of the Cloud, a "Local" Imaging Service. A Cloud Imaging Service will typically need to pass on a Job to a Local Imaging Service when the Job submitted to a Cloud Imaging Service involves physically handling hardcopy documents.

Therefore, as part of the Cloud Imaging Model, this specification defines a "reverse" interface by which the Services in a Local PWG Semantic Model Imaging System can communicate with an external Service, such as a Cloud Imaging Service, where the Cloud Imaging Service cannot initiate connections to the Local Imaging Services. . In this specification, such Local Imaging Services are contained within a Local Imaging System. Although this "reverse" interface could be used for any Imaging Service, it is most applicable for Imaging Services handling hardcopy documents and which the User Client accesses via the Cloud, either because the User and the hardcopy device are in different network domains or because there is insufficient processing capability at the hardcopy device. Accordingly, this specification considers the reverse interface with respect to the Print, Scan and FaxOut Services.

While the focus of this specification is the interface between Local and Cloud-based Services, the same interface can be used in any situation where the Imaging Devices dealing with the User hardcopy are not network accessible to the upstream Imaging Service with which the User communicates, as is common in many secure and multi-homed network environments. For example, a gateway Service might use the interface defined by this specification to provide guest printing from an open Wi-Fi network to a secure corporate LAN.

2. Terminology

2.1 Conformance Terminology

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

2.2 Protocol Role Terminology

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

Client: Cloud Imaging Client - the software component that implements the interface between the User and the Cloud Imaging Services. [PWG5108.01]

Proxy: Local Imaging System Proxy - the software component external to the Cloud that implements the interface between the Local Imaging Services and the Cloud Imaging Services in the Cloud Imaging System with which the Local Imaging System is registered.

Service: Imaging Service - one of the Services performed by an Imaging System as defined in the MFD Model and Common Semantics specification [PWG5108.01]. This specification is concerned with the communication between Cloud-based Imaging Services and Local Imaging Services.

2.3 Imaging and Cloud Terminology

Normative definitions and semantics of imaging terms used in this specification are derived from MFD Model and Common Semantics [PWG5108.01], which references V1.85 of the PWG Semantic Model Schema. Where it is necessary to denote that an entity is in the Cloud, specific PWG Semantic Model terms are prefixed with the qualifier "Cloud". Where it is necessary to denote an Imaging System entity not in the Cloud but which has direct or indirect network access to the Cloud, the PWG Semantic Model terms are prefixed with the qualifier "Local". Local Imaging System components with which Users physically interact are at some site to which Users have physical access. Both the User-friendly Location and GeoLocation Elements are applicable to these components.

Association: the process by which a User or a Client is paired with a Cloud Imaging Service.

Client-side: referring to the entities and/or processes between the Job Originator and the Cloud Imaging Service.

Cloud: the environment supporting Cloud Services such as Cloud Computing and Cloud Imaging.

Cloud Computing: "... a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." The NIST Definition of Cloud Computing [NISTSP800-145].

Cloud Imaging: a method of allowing Imaging Job Originators to use Cloud-based Imaging Services and, through those Services, to use Imaging Services in registered Imaging Systems that are not in the Cloud (i.e., Local Imaging Systems).

Cloud Imaging Client (Client): the software component that implements the interface between the User and the Cloud Imaging Services. [PWG5108.01]

Cloud Imaging Service: a cloud-resident Imaging Service consistent with the PWG Semantic Model, supporting the Semantic Model Imaging Service interface and contained within a Cloud Imaging System. A Cloud Imaging Service can communicate with one or more 'downstream' Cloud Imaging Services and/or with one or more Cloud Imaging Device Proxies.

Cloud Imaging System: the Cloud-based System that implements one or more Cloud Imaging Service. A Cloud Imaging System includes one and only one System Control Service.

Cloud Imaging System Control Service: the System Control Service of a Cloud Imaging System. As defined in System Object and System Control Service Semantics [PWG5108.06], the System Control Service responds to queries about the System Object's configuration, status and descriptive information and acts on requests to modify the System Object.

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 (MFD Model and Common Semantics [PWG5108.01].)

Document Data: the digitized data submitted by a Job Originator as the content of a Document or portion of a Document to be processed by an Imaging Service, or as the resulting data from the scanning of hardcopy Document(s) [PWG5108.01].

Down: that state of an Imaging System, Service or Local Imaging System Proxy in which it is incapable of performing its functions, as when powered down or broken.

Element: A term used to convey structure and relationships in XML Document instances [such as the XML Document used to define the Imaging System Semantic Model]. An Element can contain both content and Elements. Complex Elements are composed, at

least in part, of other Elements. [PWG5108.01]. Items referred to as "attributes" in IPP are call "Elements" in the model.

Imaging Device: a hardware entity that supports one or more Imaging Services including the System. [PWG5108.01]

Imaging Service: one of the Services performed by an Imaging System as defined in the MFD Model and Common Semantics specification [PWG5108.01]. In that specification, Imaging Services include Print, Copy, Scan, FaxIn, FaxOut, EmailIn, EmailOut, Transform and Resource Services. The conceptual (not necessarily physical) external interfaces to these Services are represented in Figure 1. Resource, EmailIn, EmailOut, FaxIn and Copy Services are not considered appropriate in a Cloud Environment and are not considered in this Cloud Model. Cloud Imaging System communication with a Local Transform Service is not considered.

Imaging System: a System, implemented in a Device, in software, or some combination of the two, that provides one or more Imaging Services. An Imaging System includes one and only one System Control Service.

Job: a data object, created and managed by an Imaging Service, that contains the description, processing, and status information of a Job submitted by a Job Originator. A Job contains zero or more Document objects [PWG5108.01].

Job Originator: the User that submits the initial request to create the Job [PWG5108.01].

Local Imaging Service: a networked Imaging Service in a Local Imaging System.

Local Imaging System: an Imaging System, such as in an MFD with network access to the Internet, that the System owner has registered with one or more Cloud Imaging Systems via a Local Imaging System Proxy. Once registered, the Local Imaging Services in the Local Imaging System can be accessible to Users through the Services in a Cloud Imaging System.

Local Imaging System Proxy (Proxy): the software component external to the Cloud that implements the interface between the Local Imaging Services and the Cloud Imaging Services in the Cloud Imaging System with which the Local Imaging System is registered.

Offline: that state of an Imaging System, Service or Local Imaging System Proxy in which it is totally inactive and unresponsive with respect to the referenced interface although it might or might not be fully operational otherwise.

Online: that state of an Imaging System, Service or Local Imaging System Proxy in which it is active and responsive with respect to the referenced interface although it might or might not be fully operational.

Owner: the entity that specifies who has access to what Imaging Services of an Imaging System (Cloud or Local), and under what conditions and limitations.

Pull Scan: a Scan Job where the resulting scan Document Data is retrieved from the Scan Service by an authorized Scan Client.

Push Scan: a Scan Job where the resulting scan Document Data is delivered to the specified destination(s) by the Scan Service.

Registration: the process by which a Local Imaging System becomes known to an Owner-identified Cloud Imaging System.

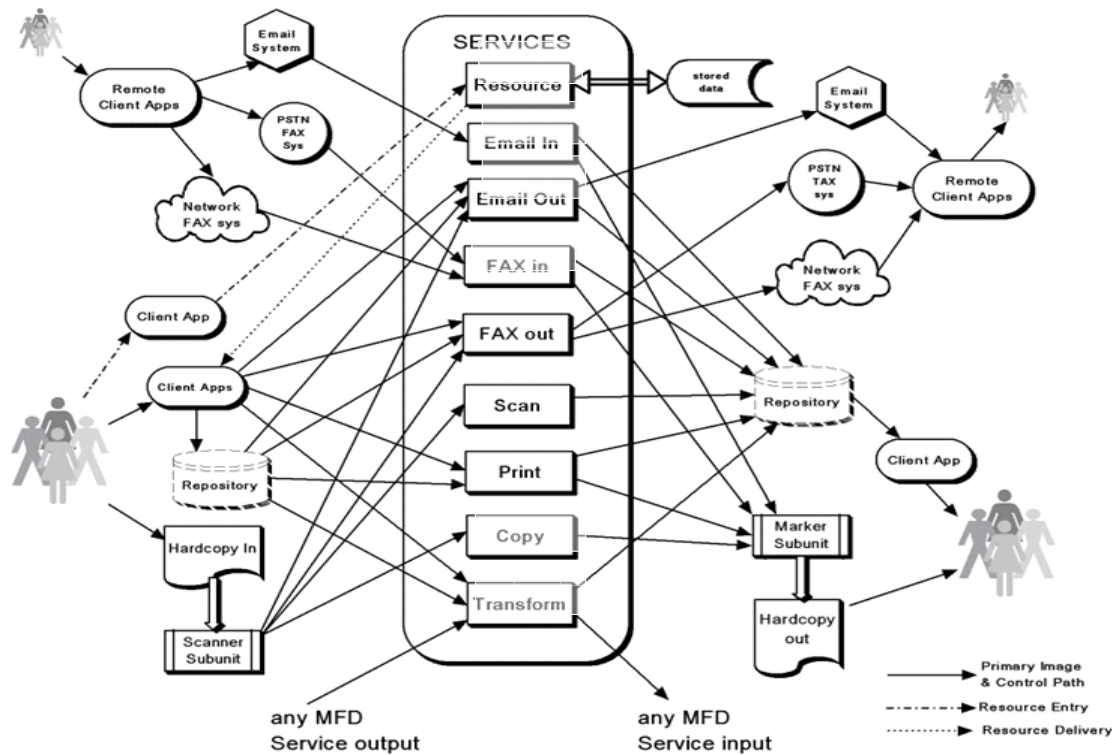
Resource: Data objects such as Job Tickets pre-configured with User's intent, Logos, Fonts, or Forms that are maintained within an Imaging System to be reused for performing a task or a executing an Imaging Job. There are three categories of Resources: Executable, including Firmware and Software types; Static, including Font, Form, Logo, Image and ICCProfile types; and Template, including Job and Document Templates. Resources are described in Network Resource Service, Semantic Model and Service Interface [PWG5108.03]. Resources are now considered to be managed by the System Control Service.

Security Domain: a bounded group of security objects and security subjects to which applies a single security policy executed by a single security Administrator. [ECMATR46].

Static Resource: a category of Resource including Font, Form, Image, Logo, and ICCProfile types, where resources are data objects contained and managed within the Imaging System for use by the system's Imaging Services. Resources are described in Network Resource Service, Semantic Model and Service Interface [PWG5108.03].

Target Device: the physical equipment with which a User accesses to insert Documents to be scanned or to get Documents that have been printed.

User: a human or software entity that has access to an Imaging System for Job submission, monitoring, or maintenance, depending upon the User's role is defined in the PWG MFD Model and Common Semantics v1.0 [PWG5108.01]. Users include the Administrators, Job Owners, Operators, members of the Job Owner's group and other authenticated entities.



Note: Imaging Services not included in Cloud Imaging Model are shaded.

Figure 1 - Networked Imaging Services and their Interfaces [PWG5108.01].

2.4 Acronyms and Organizations

AAA: Authentication, Authorization, and Accounting, <http://www.ietf.org/rfc/rfc2903.txt>, <http://www.ietf.org/rfc/rfc2904.txt>

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/>

3. Requirements

3.1 Rationale for Cloud Imaging Requirements and Model

Cloud-based applications and solutions are increasingly common and Cloud-based printing, scanning, and facsimile (collectively called "Cloud Imaging Services") are emerging in several different forms. Adopting protocols and schemas compatible with the PWG Semantic model [PWG5108.01] will help ensure the interoperability, speed and adoption of Cloud Imaging Services, and will facilitate addressing privacy, security, and legal issues involved in Cloud Imaging.

3.2 Imaging Service Use Cases

Use of Cloud Imaging Services requires that the User Client establish a connection to a Cloud-based entity (typically involving authentication and authorization of the User), although this connection might not have been established specifically to use an Imaging Service. There are several types of imaging use cases in which there is just the locally initiated connection to a Cloud Service, either by a local Imaging Service executing a User initiated Job request, or by the User Client itself. For example:

1. A Client submits a Scan Job to a Local Scan Service, with the scanned Document Data to be stored at a Cloud location.
2. A Client submits a Print by reference Job request to a Local Print Service, where the referenced document is stored in a Cloud location.
3. A Client submits a Job request to a Cloud Imaging Service (such as a Transform Service), with the result to be stored in the Cloud.

Standard file access protocols are used in the first two types of use cases; in the third type of use case, existing standard network imaging protocols following the MFD Model [PWG5108.01] may be used. That is, these types of use cases are well addressed by existing models and their implementations.

However, for end-to-end Cloud Imaging where a Job request is submitted by a Client to a Cloud Imaging Service and requires the use of a Local Service, interaction is required both between the User and the Cloud Imaging Service and between a Cloud Imaging Service and a Local Imaging Service. Because the Cloud Imaging Service typically cannot initiate access to a Local Imaging Service, standard file access protocols and existing standard network Imaging protocols cannot be used. The User need not be part of the Cloud Service Security Domain and might not be directly connected to the Security Domain in which the Local Imaging Service exists. Also, the Local Imaging Service need not be part of the Cloud Imaging System Security Domain. This class of use case is the primary concern of this specification.

The following use cases envision typical applications of the various Services that can be provided by a Cloud Imaging System. For each such application, exception conditions (such as equipment faults) might arise that affect the interaction with the User. To simplify the text, basic use case outcomes are outlined assuming no such exceptions. The interaction under typical exception conditions is separately described in Section 3.3.

3.2.1 MFD Registration

A company wishes to make selected Imaging Services that are supported by the company's MFD accessible through the Cloud. Access is to be limited to designated Users.

3.2.2 Print Attached Document Data to Remote Print Service

A Job Originator locates a Cloud Print Service that he is authorized to use, that can process his Document, media format and content with his desired print intent and that can make the printed hardcopy available where and when he wants it. The Client software checks the status of the Cloud Print Service and of the Remote Print Service. He then submits a Document for printing. Later he checks the status of his request and ultimately of the printed Document.

3.2.3 FaxOut From Hardcopy Input

The Job Originator physically locates a scanner that supports sending Facsimiles via a Cloud Service and which she is authorized to use. Using a Facsimile Client application on her 'smart' phone, she connects to the Cloud FaxOut Service associated with that scanner. After authentication and authorization steps, the Job Originator identifies the scanner she wishes to use, the facsimile processing information and the facsimile destination(s). On acknowledgement of this information, she loads her original on the Scanner Automatic Document Feeder (ADF) and signals that scanning can start. Under control of the Cloud FaxOut Service, the original is scanned and the Document Data is formatted and transmitted to the specified destinations.

Upon completion, a transmission report (and a Transmission Log) is generated by the Cloud FaxOut Service. The transmission report is accessible to the Job Originator.

3.2.4 Print or FaxOut Referenced Document

The User has a URL reference for the Document Data he wishes to print or fax. This Document can be freely accessed on the Web. He locates an appropriate Cloud Imaging Service that he is authorized to use and that reports support of obtaining a source Document by reference. After authentication and authorization steps, the User provides the URL of the source Document, the facsimile or print processing information and the facsimile destination(s) or location of the desired Printer.

Job status is available to the User, either in response to a query or by some notification method. For Facsimile Jobs, a transmission report (and a Transmission Log) is generated by the Cloud FaxOut Service. The transmission report is accessible to the User.

3.2.5 Scan Document Initiated from Local Scan Service

The Job Originator connects to the Cloud Scan Service provided for her department. With the User-friendly interface provided by her Scan Client, she enters the scan process parameters and intended destination of the digital image file. She then walks over to the department scanner and, when the scanner indicates that it is ready for her Job, inserts her Document and presses GO.

The Cloud Imaging Service receives the scan data, reformats the data as directed and delivers it to the selected destination. This can be a location in the Cloud, a repository at the Users location, or directly to the Users terminal.

3.2.6 Scan Document Initiated from MFD

The Job Originator goes to a publicly accessible MFD in a hotel, enters identifying information, inserts the copy to be scanned in the ADF, and selects SCAN from the MFD control panel. In response to prompting from the panel, she enters scan parameters and intended destination of the digital image file.

The MFD sends the scan request to the Cloud Imaging System which checks that the Job Originator is authorized to receive the desired service. Provided that she is so authorized, the Scan Service in the Cloud Imaging System instructs the MFD 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.

3.3 Use Case Exceptions

There is the potential for some problem to arise in a use instance, including any of those given above. These problems might be jams or out-of-supply issues with the end devices, communication problems somewhere in the path, Administrators taking preemptive actions, or other things that interfere with the execution of a Job. These are called Exceptions. The model provides for communication of Exceptions to the User Client, potential recovery procedures and, where necessary, logging of Exception events. This section describes common exceptions to the use cases in Section 3.2.

3.3.1 Paper Out Exception

In performing some imaging service requiring printing, the Local Print Service can run out of the specified media. This condition is reported to the Cloud Imaging Service which communicates the status to the Client. For an Out-of-Paper fault, the User can be given the option of cancelling the Job or allowing it to remain in a suspended state until the fault is resolved or some other action is taken.

3.3.2 Scan Bulb Failure Exception

In performing some imaging service requiring scanning, the illumination source within the Scanner fails, rendering the scanner inoperable. In this case, the Service itself can abort the Job (and report this to the Client) or it can communicate the status to the Client and allow the Job Originator to cancel the Job, wait for the failure to be resolved, or select an alternate Imaging Service.

3.3.3 Document Data Access Exception

During retrieval of Document Data by Reference, a failure occurs in accessing the referenced Document Data. The component doing the access reports the failure.

3.3.4 User Client Cancel Job Exception

The User cancels a Job that has been accepted by a Cloud Service.

3.3.5 Operator Cancel Job Exception

An Operator with access to the Local Imaging Service or the Local Imaging System Proxy or an Administrator of the Cloud Imaging Service intentionally cancels a Job. The communication of this changed Job State is communicated back to the User.

3.3.6 Local Component Reject or Abort Exception

A Job Originator's request is rejected or aborted by a Local Imaging Service or Local Imaging System Proxy. It might be possible for the Cloud Imaging System components to take remedial action to redirect the request. The User Client is informed of the event, and whether or not remedial action is taken. The Job Originator can elect to cancel the Job. If the Job is redirected, the User's intent as expressed in the Job Ticket information is adhered to and the User has access to the revised Job state and status information.

3.3.7 Communication Exception

Communication is lost between a Cloud Imaging Service and a downstream Component. When communication is restored, the downstream component realigns its Job statuses with those in the Cloud Imaging Service.

3.4 Out of scope

The detailed definitions of the following Elements and aspects of Cloud Imaging are out of scope for this specification, although they might be referred to in the Model discussion.

1. Defining Cloud federation interfaces and associated protocols and technologies.

2. Defining the interface between the Local Imaging System Proxy and the Local Imaging Services; this Proxy component can be part of the Local Imaging System in which case it is an “internal” interface; or it can be external, possibly serving multiple Local Imaging Systems, in which case it might use standardized Network Imaging Service interfaces.
3. Defining the interface between the User and the Client.
4. Defining the interface for Association (enrollment) of a Client with a Cloud, Cloud Imaging System, or Cloud Imaging Service.
5. Defining the management and configuration interface for the Local Imaging System Proxy.
6. Defining new protocols for authentication, authorization, and access control (AAA), enumeration, transport, notification, or system management.
7. Defining how authorized User credentials are communicated during Local Imaging System registration.
8. Defining new Document file formats.
9. Defining new abstract Job Tickets.
10. Defining specific interfaces within the Cloud environment to manage and configure the Cloud Imaging System.
11. Defining the interface by which Users, including potential Job Originators are associated with the Cloud.
12. Defining Cloud-based management of the out-of-Cloud Imaging Systems.

3.5 Design Requirements

Because the PWG Cloud Imaging Model requires two asynchronous sets of interactions to complete any Job Originator to Local Imaging Service action, the design requirements of the PWG Cloud Imaging Model are presented in terms of the requirements on interactions between the Client and the Cloud Imaging Services and interactions between the Local Imaging System Proxy and the Cloud Imaging Services.

3.5.1 Client-to-Cloud Imaging Service - Design Requirements

With respect to the imaging specific aspects, the Client-Cloud Imaging Service interface serves the same functions, exercises the same operations, and uses any of the same imaging protocols as a corresponding Imaging Service that is compatible with the PWG Semantic Model as specified in the MFD Model and Common Semantics [PWG5108.01]. Therefore, requirements on the Model (but not necessarily on any specific implementation) are:

1. The Cloud Imaging Service model follows the state and transition definitions for a Service as defined in Sections 7.1 and 7.2 of the MFD Model and Common Semantics [PWG5108.01],
2. The Cloud Imaging Service model follows and the Cloud Client model recognizes the Job and Document states and transitions as defined in sections 7.2.2 and 7.2.3 of the MFD Model and Common Semantics [PWG5108.01],

3. The Cloud Imaging Service model supports the Service Operation Requests and Responses as identified described in section 7.3 of MFD Model and Common Semantics [PWG5108.01] to the extent that the operations are appropriate to the Service type; the Cloud Client model uses these requests and accepts the responses to the extent compatible with the capabilities it is to supply to the User.
4. The Cloud Imaging System Model includes a System Control Service that is in accord with Section 7 of the System Object and System Control Service Semantics [PWG5108.05]. This Service allows management of the Cloud Imaging System by authorized Users.

In addition,

5. All communications between the Client and the Cloud Imaging Service are made via secure connections ensuring data integrity and confidentiality.

3.5.2 Proxy-to-Cloud Imaging Service - Design Requirements

The communication between a Cloud Imaging Service and the Local Imaging Service could be the same as that between Client software in an upstream Imaging Service and an Imaging Service in a Networked Imaging System were it not for the probable presence of a firewall preventing the Cloud Imaging Service from initiating requests and submissions to the Local Imaging Service. Instead, the Cloud Imaging Model includes an intermediary actor called the Local Imaging System Proxy between the Services in the Local Imaging System and the Cloud Imaging Services to implement a set of operations that allow the communication of Local Imaging Service configuration and state information and Job and Document state information to the Cloud Imaging Service; and the communication of Job Ticket and Document data to the Local Imaging Service.

1. The Cloud Imaging Service model and the Local Imaging System Proxy model follow the state and transition definitions for a Service as defined in Sections 7.1 and 7.2 of the MFD Model and Common Semantics [PWG5108.01],
2. The Local Imaging System Proxy model follows and the Cloud Imaging Service model recognize the Job and Document states and transitions as defined in sections 7.2.2 and 7.2.3 of the MFD Model and Common Semantics [PWG5108.01],
3. The Cloud Imaging Service model supports a set of interface requests and responses and the Local Imaging System Proxy model issues these requests and accepts the responses to allow communication of the following types of information:
 - a. Local Imaging Service Capabilities, Configuration and Status.
 - b. Job Request Information, including Job Tickets, Document Tickets and Document Data
 - c. Job and Document Status
4. The interchange defined by the Cloud Imaging model between the Local Imaging System Proxy and the Cloud Imaging Service provides some method

- by which the Cloud Imaging Service can determine whether a disruption in the communication has occurred.
5. The Local Imaging System Proxy model provides and the Cloud Imaging Service model supports provisions to allow the synchronization of Job and Document status and the update of Local Imaging Service status in normal operation and on recovery after occurrences such as disruption of communication or hard reset of the Local Imaging System Proxy.
 6. Although an optional capability, the Cloud Imaging Model allows for the Cloud Imaging Service to notify the Local Imaging System Proxy that information is available or a request for information is present and that the Local Imaging System Proxy should contact the Cloud Imaging Service.

In addition,

7. All communications between the Local Imaging System Proxy and the Cloud are made via secure connections ensuring data integrity and confidentiality.
8. A log of all Job transactions is maintained, either by the Cloud System Control Service or the individual Cloud Imaging Services. This log includes, at a minimum, Job Identification, Job Originating User, selected Cloud and Local Imaging Services, date/time of transaction, and resources used. The log is necessary for accounting as well as resource monitoring and maintenance purposes. The log follows the format defined in PWG Common Log Format [PWG5110.3]. Log entries are retained long enough to ensure that information can be accessed, according to policy established when the Cloud Imaging System is created.

3.5.3 Privacy and Security Policies

The use of Cloud connections for handling imaging Jobs requires attention to security consistent with the Cloud policy(ies). Requirements include but are not necessarily limited to authentication and authorization for access of Clients and Local Imaging System Proxies to Cloud Imaging Services, ensuring internal and transport integrity and privacy of all imaging data, and secure logging and access to use data.

The specifics of security provisions are out of the scope of this specification. However, basic security aspects of the Model require that:

1. In connections between a User and a Cloud Imaging Service, both parties are to be identified and authenticated in accord with the access policies established for the Cloud Imaging Service.
2. User authenticated identity is to be used to determine User Service restrictions and Local Imaging Service access restrictions in accord with the access policies established when the Local Imaging System was registered with the Cloud Imaging System.
3. In connections between a Cloud Imaging Service and a subsequent Cloud Imaging Service that is not a part of the same Cloud Imaging System, both parties are to be identified and authenticated in accord with the policies

established when the relation between the two Imaging Services was established or last updated.

4. In connections between a Local Imaging System Proxy and a Cloud Imaging Service, both parties are to be identified and authenticated in accord with the access policies established when the Local Imaging System was registered with the Cloud Imaging System.
5. All Document data transmitted between Clients, Cloud Imaging Services and Local Imaging System Proxies are to be encrypted and protected from alteration according to security policies established in the relationship between the components and at a level commensurate with the sensitivity of the information.
6. All Document data within a Cloud Imaging Service is not to be accessible to any agent other than the authenticated Job Originator (through his Client) and the Local Imaging Service selected by the Job Originator.
7. The operations and messages in the model do not require the transmission of any information that violates standard best practices for data security.

4. Cloud Imaging Model

4.1 Cloud Imaging Model Overview

The PWG Cloud Imaging Model is represented in Figure 2. The Cloud Imaging System contains a System Control Service, and can contain any number and type of Imaging Services. The User, operating through a Client, communicates with a specific Cloud Imaging Service within the Cloud Imaging System in the same way as with any Networked Imaging Service. For Imaging Jobs in which the Cloud Imaging Service stores or transmits the Document Data Job output, this standard Client-Service interface is sufficient. However, because of restrictions on Cloud-based components initiating communication with Local Imaging Services, Services in the Cloud Imaging System cannot send messages to Local Imaging Services. Therefore, for Imaging Jobs in which the Cloud Imaging Service is to pass the Job on to a Local Imaging Service, the Cloud Imaging Model includes a Local Imaging System Proxy (Proxy) which monitors the Cloud Imaging Services to pull Job request information to the Services within the Local Imaging System and to provide Local Services and Job Status information to the Cloud Services.

Note that, although the model provides for a Cloud Imaging System User Client to access a Cloud-based Transform Service, it does not provide for access to a Local Imaging System based Transform Service through a Cloud Imaging System. This is because, unlike with the other Imaging Services, there is no need for a User to have physical access to the device performing a Transform Service since both input and output are digital rather than hardcopy. Furthermore, because of the potentially computationally intensive nature of Transform Jobs, broad capability Transform Services are more likely to be found in the Cloud than in Local Imaging Systems. Although Local Imaging System access to Cloud-based Transform Services is useful and likely, and might reasonably use Proxy capability, such an interface is a Client-Service interface with the Local Imaging System acting as the Client. That is, it would use the Client Imaging Service Network interface rather than the Proxy-Cloud Imaging Service interface.

The Proxy can be within the Imaging System hardware or external to it; it can serve just one Imaging System or more than one. The interface between the Proxy and the Services in the Local Imaging System(s) is out of scope for this specification but, since the Proxy-Cloud Imaging System interface uses standard Semantic Model Elements, an interface compatible with the PWG Semantic Model Client-Imaging Service interface is readily accommodated.

Any component in the path can contribute to satisfying the Job request. For example, a Cloud Print Service could convert a submitted PDF formatted Document into a complete set of page rasters and pass these through the Proxy to a Local Print Service for marking on paper. At the other extreme, the Cloud Print Service and Proxy could pass the PDF formatted Document unmodified to a Print Service in an MFD. Although the data content can vary, the interfaces remain the same.

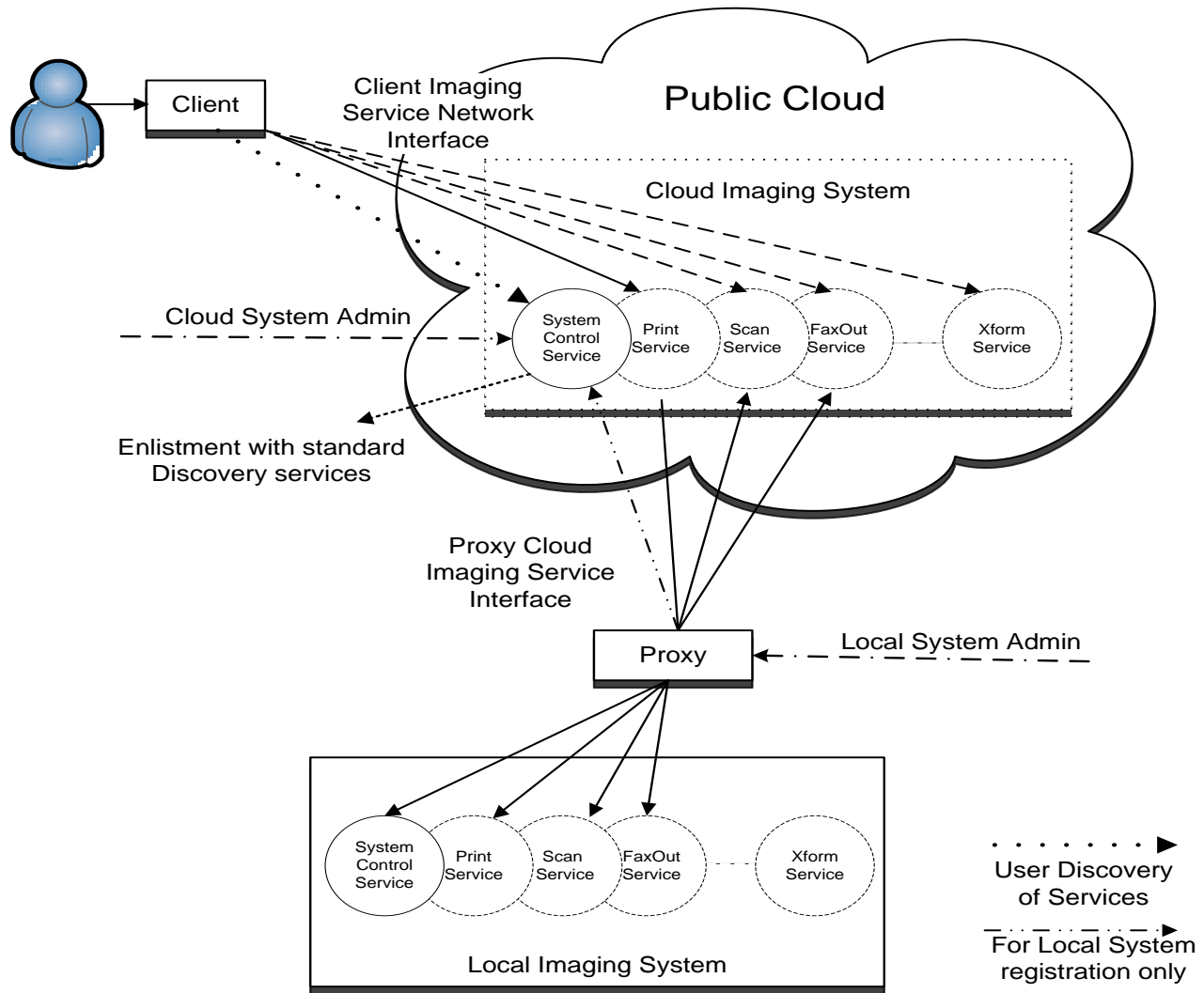


Figure 2 - PWG Cloud Imaging Model

Although Figure 2 shows the same communication paths for Print, Scan and FaxOut services, the sources, destinations and forms of Document Data vary according to Service. Table 1 summarizes these. The hardcopy produced by the Local Print service can be derived from Document Data provided by the Cloud Print Service (either provided by the User/Client or from a reference provided by the User/Client) or obtained by the Local Print Service or Proxy from a reference provided by the Cloud Print Service. The Document Data produced from hardcopy by the Scan Service is stored at a destination defined by the User and communicated by the Cloud Scan Service or uploaded to the Cloud Scan Service. The DocumentData source for FaxOut is more complicated because it may consist of Document Data obtained in that same way as for Print, and/or Image Data obtained in the same way as for Scan. Although the ultimate destination for FaxOut is defined by the User, this is reached via communication ports (FaxModem or Internet) located either Locally or in the Cloud Service (or both). The immediate destination for FaxOut document may be a Local port and/or the Cloud FaxOut Service.

Table 1 - Services Document Data Source and Destinations

Service	Document Source	Source Form	Destination	Destination Form
Print	Supplied by Client	digital data	Local Service (Marking Engine)	Hardcopy
	Obtained from Reference			
Scan	Local Service (Scanner)	hardcopy	Defined by User Could be multiple	Digital Data
FaxOut	Supplied by Client	digital data	Fax address defined by User Could be multiple	Fax form defined by User, possibly negotiated with Destination device
	Obtained from Reference			
	Local Service (Scanner)	hardcopy		

4.1.1 Establishing Relationships

It is a prerequisite of this Model that the User and his Client, the Local Imaging System and its Proxy, and the Cloud Imaging System exist and that the Client and the Proxy can each connect to the Cloud Imaging System. The Model further assumes (but does not define specifics for) the following:

1. The System Control Service in the Cloud Imaging System has an administration/management interface by which the Cloud Imaging System is configured:
 - a. With information in regard to Imaging Services and capabilities to be supported. The Cloud Imaging Services can be created as a result of this configuration process, or they can be pre-provisioned so that they are created when a Local Imaging System Proxy communicates the availability of corresponding Local Imaging Services.
 - b. With information controlling User access in regard to identity and authorization, and User access policy is defined.
 - c. To allow access by identified Local Imaging System Proxies.
2. The Local Imaging System Proxy has an administrative/management interface by which the Local Imaging System Owner can configure the Proxy to register Local Imaging Systems with Cloud Imaging Systems and cause the selected Imaging Services in proxied Local Imaging Systems to be linked with corresponding Cloud Imaging Services.

After the Cloud Imaging System and a Local Imaging System Proxy have been configured, the Proxy connects to the Cloud Imaging System Control Service on behalf of the Local Imaging System. Standard communication security procedures are used to establish mutual authentication and authorization. The Proxy communicates Local Imaging System Elements, including Local Imaging Services to be made accessible to the Cloud Imaging System during Registration. Once a Local Imaging System is registered, a relationship is established between the identified Services in the Local Imaging System and the corresponding Cloud Imaging Services. The Local Imaging Services can then be made available to Users through the Cloud Imaging Services.

Note that Registration of a Local Imaging System with a Cloud Imaging System inherently creates a very specific type of notification subscription of the Local Imaging System Proxy with each of the Cloud Imaging Services corresponding to the Local Imaging Services that are being made accessible. These inherent subscriptions remain in effect as long as the Local Imaging System remains registered with the Cloud Imaging System.

Before any Imaging transactions can occur, the Client 'discovers' the Cloud Imaging System providing the desired Services under the desired conditions of capabilities, cost, location, etc. Typically, this discovery is done in one of two ways:

- Client-side account credentials point to a specific Cloud System Control Service; Client then uses a ListAllServices operation to get a list of available services.
- Standard discovery protocols (LDAP, DNS-SD, etc.) are used for providing access to public services (e.g. hotel managed printing services)

Once the desired Cloud Imaging System is located, communication security procedures are used to establish mutual authentication and authorization between the Client and that Cloud Imaging System (containing the Cloud Imaging Services). This establishes a relationship between the User and the Cloud Imaging Services (which is termed Association).

The communication security procedures to be used between Client and Cloud and between Proxy and Cloud, and the procedure for establishing Association are out of the scope of this specification.

4.1.1.1 Local Imaging System Registration.

To register a Local Imaging System, the Owner will have independently communicated with the Administrator of the Cloud Imaging Service to arrange for his Local Imaging System to be registered. The Local Imaging System Owner has the URL of the Cloud Imaging System Control Service, and the Cloud Imaging System has been configured to accept a connection from the Local Imaging System Proxy for the Owner's System.

1. The Local Imaging System Owner provides information to the Proxy about which Services of which System are to be registered with what Cloud Imaging System and the address of the Cloud Imaging System Control Service.
2. The Proxy establishes a connection to the Cloud System Control Service and sends a message that provides information on all System Elements of the Local Imaging System (Description and Status) that are to be made known to the Cloud Imaging System. This is done independently for each proxied Local Imaging System to be registered. This message includes, at a minimum, the standard Operation Elements (e.g., ElementsNaturalLanguage, RequestingUserName, RequestingUserUri), the identification of the Services to be made accessible, and the following System Description and System Status Elements:

- a. CharsetConfigured
 - b. NaturalLanguageConfigured
 - c. MakeAndModel
 - d. OwnerUri
 - e. SystemGeoLocation
 - f. SystemLocation
 - g. SystemName
 - h. ConfiguredServices
 - i. LocalSystemUuid
 - j. State (of the System)
 - k. ResourceKOctetsRequested (if Resource material is to be made available to the Cloud Imaging System.)
3. The Cloud Imaging Control Service responds with the registration status of the Local Imaging System. The Cloud Imaging Services that are to be linked to identified and accepted Local Imaging Services are created, if they do not already exist. For each accepted Local Imaging Service, the Cloud Imaging Control Service provides the address of the corresponding Cloud Imaging Service.
 4. The Cloud Imaging System can provide a directory for the Cloud storage and hosting of Resources contained in the Local Imaging System being registered. This allows the Resource data objects in the Local Imaging System to be accessed by the Client and the Cloud Imaging System. This directory is unique to the Local Imaging System being registered and is accessible to the Proxy using a standard network file read/write protocol, subject to appropriate authentication and access control provisions. Resource objects are described in the PWG Resource Service Model specification [PWG 5108.03-2009] and are currently considered managed by the System Control Service. If the Cloud Imaging System does provide for Resource storage specific to the Local Imaging System being registered, it includes the following Elements in its response to the Local Imaging System registration request:
 - a. ResourceDirectoryUri: The URI of the directory.
 - b. ResourceKOctetsSupported: Total capacity of Resource Directory for this Local Imaging System
 - c. ResourceKOctetsFree: Remaining free capacity of Resource Directory for this Local Imaging System. Initially this will be the same as ResourceKOctetsSupported.
 5. The Proxy establishes connection to the Cloud Imaging Service for each accepted Local Service and sends a, update message that identifies the Local Imaging Service Elements and their values that are to be accessible to Users through the Cloud Imaging Service. At a minimum, this initial update message includes the following:
 - a. CharsetConfigured
 - b. NaturalLanguageConfigured
 - c. ServiceName
 - d. ServiceUuid
 - e. State

- f. StateReasons
- g. IsAcceptingJobs

After System registration and Service initialization are complete, the Local Imaging System Proxy updates System Elements to the Cloud System Control Service and updates Service Elements to the corresponding Cloud Imaging Services as necessary to keep the Cloud Services aware of the status and configuration of the Local Imaging System and its Services.

The Proxy also periodically queries each Cloud Imaging Service to verify communication capability and to check for waiting Jobs, error notifications or identify requests.

This periodic sending of messages acts as a polling of the Cloud Imaging Services by the Proxy. In some circumstances it is possible to lower the polling rate and/or provide faster notification of waiting Jobs or other actions by supplementing these periodic queries with asynchronous notification messages initiated from the specific Cloud Imaging Services.

4.1.1.2 Loss of Communication

The effectiveness of Cloud Services relies upon reliable, timely communication between Client and Cloud Service and between Proxy and Cloud Service. The Client can readily inform the User when there is a communication difficulty with the Cloud Service. The Proxy can also determine if there communication problems with the Cloud Service; but Proxy communication problems are less easily determined by the Cloud Service.

The Cloud Service and the Local Service, operating through the Proxy, are to stay synchronized, particularly with respect to Jobs. Communication failure typically results in loss of synchronism. Cloud Imaging implementations might reasonably act as follows with respect to Proxy-detected communication failures:

1. If a Proxy is unable to connect with a Cloud Imaging Service, or if it does not receive a timely response to an operation directed to a Cloud Imaging Service, the Proxy continues to send periodic queries to that Service and to the Cloud System Control Service containing the Cloud Imaging Service:
2. If the Cloud System Control Service responds that the subject Cloud Imaging Service is down, the Proxy considers the Cloud Imaging Service Offline
3. If the Cloud System Control Service does not respond for some minimum time, the Proxy considers the Cloud Imaging System Offline. However, periodic queries continue.
4. If the Cloud Imaging System does not respond for some minimum time, even if the Cloud System Control Service reported the Imaging Service as operational, the Proxy considers the Cloud Imaging Service Offline. However, periodic queries continue.
5. If the Proxy considers the Cloud Service to be Offline, it causes the Local Service to adjust the state of Jobs accepted from that Cloud Service as shown in Table 2.

6. If connections resume with a Cloud Service (Imaging or System Control) after that Service is considered Offline but before that system is considered "Down", the Proxy updates the status of the Local System or Service and, for an Imaging Service, lists all Active Jobs obtained from the Cloud Service and provides the status of Jobs and Documents. In the case of Jobs, the response from the Cloud Service can cause the Proxy to resume processing or to cancel Jobs in the Local Service.
7. If communication is not re-established before a "Down" period, the Proxy considers the Cloud Service "Down" and causes the Local Service to adjust the state of Jobs accepted from that Cloud Service as shown in Table 2.
8. The Proxy might continue to attempt communication with the Cloud System Control Service. If and when communication is re-established with the Cloud System Control Service, the Proxy re-registers all Local Imaging Systems that were previously registered with that Cloud System (even if communication with other Services in that Cloud Imaging System has not been interrupted.)

Table 2 - Local Service Job State Transitions on Cloud Service Communication Failure

Job State in Local Service (Note 1)	After Cloud Service Considered			
	Offline		Down	
	Effective Proxy Op (Note 2)	Job State	Effective Proxy Op (Note 2)	Job State
Pending	HoldJob	Pending Held	JobCancel	Canceled
Pending Held				
Processing	PauseService	Processing Stopped		
Processing Stopped				

Note 1: Jobs initially in a Competed State (Cancelled, Completed or Aborted) remain in that state.

Note 2: Proxy detects communication failure and requests Job State change in Local Service. The effective Proxy operation assumes standard network interface with Local Imaging Service, but resulting Job State is as indicated regardless of Proxy-Local Service interface.

Detection of an Interruption in the periodic queries of the Cloud Service by the Proxy is part of a procedure by which the Cloud Imaging Service can detect a communication or operational problem with the Proxy. This determination is complicated by the fact that connectivity is a Proxy to Cloud Service function while the periodic queries are specific to a Local Imaging Service. The Proxy potentially sends these queries to several Cloud Services in a given Cloud Imaging System, and on behalf of multiple Imaging Services in multiple Local Imaging Systems. If all of the Cloud Services in a given Cloud Imaging System time out with respect to communication with a given Proxy, there obviously is a connectivity problem or the Proxy is down. However, if queries fail for just one Local Service, the nature of the difficulty is less clear, although the Cloud Service can still notify the Client of the problem and will cause the Cloud Service to consider the Local Service as

Offline. Handling of Jobs sent to an Offline or Down Local Service is implementation dependent.

In general, if there is a communication failure as distinct from an intentional shutdown, communication will eventually be resumed. Although the Proxy will take action to resume synchronization, the Cloud Imaging Services will also have taken some actions in the interim and can also require certain resynchronization operations.

4.1.1.3 Modifying Registration or Deregistering Local Imaging Systems

Although the update operations keep the Cloud Services abreast of changes at the Local Imaging System and its Services, the Local Imaging System Owner might wish to change the Services or Elements that are available for Cloud use. Such changes are initiated by the Owner communicating with the Local Imaging System Proxy. The Proxy will then re-register, eliminating or adding Services.

If a Local Imaging System Registration with a Cloud Imaging System is to be ended, a specific message is sent to deregister the System and all Imaging Services of that System. As indicated above, the failure of the Proxy to communicate with the Cloud Imaging Services for an extended period will also cause registration to be suspended

4.1.2 Authentication, Authorization, and Access Control (AAA) Framework

For the purposes of this specification, the Client, Cloud Imaging System, Proxy, and Local Imaging System are pre-existing entities. All (except for possibly the Local Imaging System) use a common method for performing authentication, authorization, and accounting between multiple entities, referred to as the AAA framework. See the Generic AAA Architecture [RFC2903] and AAA Authorization Framework [RFC2904]. The Local Imaging System can be in the same equipment as the Proxy or can be separate from the Proxy; the Local Imaging System can be either within or outside of the AAA framework.

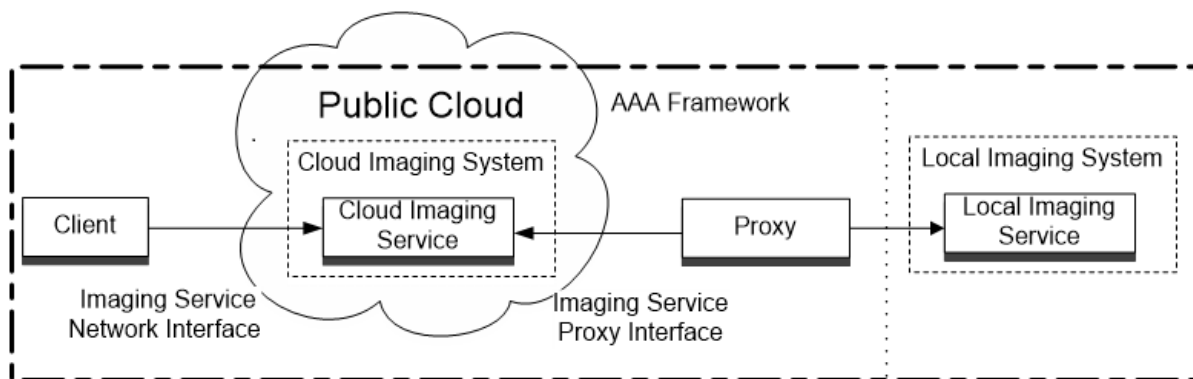


Figure 3 - AAA Framework

4.1.3 Fanout

The model allows many branching configurations, as represented in Figure 4. Note that, as suggested in the IPP 1.1 standard [RFC2911], fanout to a "downstream" component requires a Client interface, and when that component is an Imaging Service, this Client interface could use the same as the modeled User Client interface. Allowable fanout configurations are described below.

1. A Cloud Imaging System can contain multiple Imaging Services of the same type (e.g., multiple Print Services).
2. A Cloud Imaging Service can interface with one or more 'downstream' Imaging Services of the same type, either within the same Imaging System or in a different Cloud Imaging System.
3. A Local Imaging System Proxy can interface with more than one Cloud Imaging Service of the same type (e.g., Print) and with more than one type of Cloud Imaging Service (e.g., Print and Scan).
4. A Local Imaging System Proxy can interface with Services in more than one Cloud Imaging System.
5. A Local Imaging System Proxy can be embedded within a Local Imaging System equipment set or it can be in separate equipment, including as software in a general purpose computer.
6. A Local Imaging System Proxy can interface with the Services in more than one Local Imaging System.

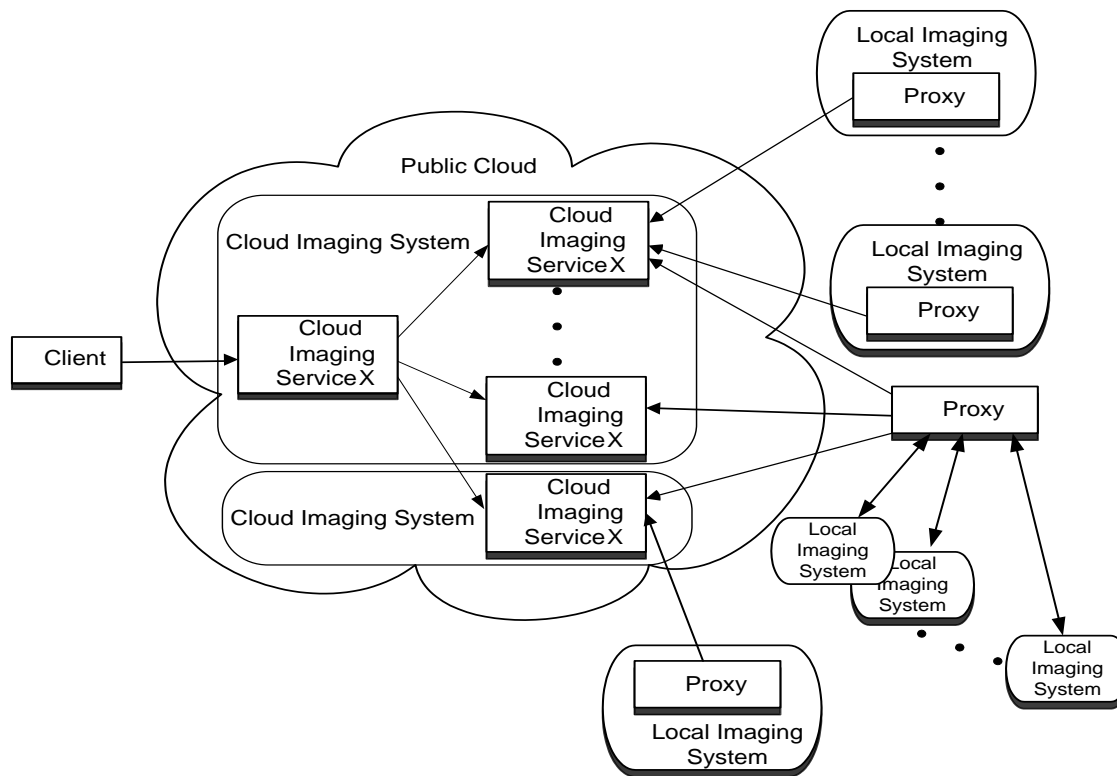


Figure 4 - Various Fanout Options

4.2 Cloud Imaging Operations

This section describes Client to Cloud Service and Local Imaging System Proxy to Cloud Service messages in a conceptual rather than implementation-specific context.

1. Connections between Client to Cloud Service and Proxy to Cloud Service are subject to security procedures ensuring identification, authentication and authorization of both initiator and respondent to a level appropriate to the value of the service be used and the sensitivity of the information being communicated.
2. All messages are initiated by the Client to the Cloud Service (for Client-side operations) or by the Proxy (Local Imaging System Proxy Operations) to the Cloud Service.
3. Unless a message is rejected and a response is precluded by security reasons, every message is to have a response from the addressed Service. In addition to information specific to the operation, a response includes an OperationStatusCode and possibly a text status message indicating the action on the requested operation.
4. Clients and Proxies do not necessarily need to have a response from a previous message before sending a subsequent message.
5. Services do not necessarily need to respond to messages in the order received.

Depending on protocol and security capabilities, implementation of this Cloud Imaging Model might communicate the identified information by other mechanisms. For example, notification information might be communicated to a Proxy by a Cloud Service using an asynchronous communications protocol.

4.2.1 Client Side Basic Operations

A basic contention of this Cloud Imaging Model is that Client to Cloud Imaging Service communication of imaging operations is no different from established Client to Networked Imaging Service operations, as defined in the PWG Semantic Model MFD Model and Common Semantics [PWG5108.01]. The common Basic operations are listed in Table 3. They are directed from a Client to a specific Imaging Service within a Cloud Imaging System and are concerned with creating and controlling Jobs and Documents within Jobs in the Cloud Imaging Service. Except for IdentifyDevice and AddDocumentImages, which are new, these basic operations are described in detail in MFD Model and Common Semantics [PWG5108.01].

Although in most cases, operations affecting Jobs in the Cloud Imaging Service will be reflected to corresponding Jobs in the Local Imaging Services by way of the communication between the Local Imaging System Proxy and the Cloud Imaging Service, these operations from the User/Client do not act on the Local Imaging Services' Jobs directly.

The Operations include those by which a Client gets Service Elements to allow the User to select Services and formulate Job Tickets. Some of these operations do affect the state of a Job. However, none of these operations directly affect the state or configuration of the Local Service except to the extent that creating or canceling a Job can initiate a sequence that affects the Service.

Table 3- Client/Cloud Imaging Service Basic Requests and Responses

Operation	Request Parameters (Note 1)	Response Parameters (Note 2)	Note
AddDocumentImages	JobUuid; JobId ; DocumentTicket InputElements LastDocument	DocumentNumber UnsupportedElements	
CancelCurrentJob	JobUuid; JobId ;		
CancelDocument	JobUuid; JobId ; DocumentNumber		
CancelJob	JobUuid; JobId ;		
CancelMyJobs	JobIds	JobUuid; JobId	3
CloseJob	JobUuid; JobId ;		
CreateJob	JobTicket JobPassword(, , JobPasswordEncryption;	JobUuid; JobId ; UnsupportedElements	
GetActiveJobs	Limit FirstIndex	ActiveJobs (JobSummaries (including JobId; JobName; JobOriginatingUserName; JobState; ImpressionsCompleted or ImagesCompleted, JobStateReasons)	
GetDocumentElements	JobUuid; JobId ; DocumentNumber; RequestedElements	Document (DocumentReceipt, DocumentStatus, DocumentTicket) UnsupportedElements	
GetDocuments	JobUuid; JobId Limit FirstIndex	JobUuid; JobId ; Documents (list of DocumentSummaries including DocumentNumber, DocumentState, DocumentStateReasons, ImpressionsCompleted or ImagesCompleted; JobName) UnsupportedElements	
GetJobElements	JobUuid; JobId RequestedElements (JobReceipt; JobStatus; or JobTicket.)	Job ; (JobReceipt; JobStatus; JobTicket.) UnsupportedElements	
GetJobHistory	Limit FirstIndex	JobHistory (JobSummaries for subject Jobs including JobId; JobName; JobOriginatingUserName; JobState, ImpressionsCompleted or ImagesCompleted, and perhaps JobStateReasons)	
GetNextDocumentData	DocumentDataWait JobId;	Compression, DocumentFormat , DocumentDataGetInterval, LastDocument(DocumentNumber, DocumentData	
GetServiceElements	Limit FirstIndex, RequestedElements (ServiceCapabilities; ServiceConfiguration; ServiceDescription; ServiceStatus, DefaultJobTicket.)	ServiceElements(DefaultJobTicket, ServiceCapabilities ServiceCapabilitiesReady, ServiceConfiguration, ServiceStatus, as requested) UnsupportedElements	
HoldJob	JobHoldUntil or JobHoldUntilTime, JobUuid; JobId,		

Operation	Request Parameters (Note 1)	Response Parameters (Note 2)	Note
HoldNewJobs	JobHoldUntil or JobHoldUntilTime,		
IdentifyDevice	IdentifyActions	DeviceID; MakeAndModel; SystemGeoLocation; SystemName	
ReleaseJob	JobUuid; JobId		
ResubmitJob	JobUuid; JobId	JobUuid; JobId; UnsupportedElements	
ResumeJob	JobUuid; JobId		
SendDocument	JobUuid; JobId DocumentTicket LastDocument DocumentData DocumentPassword	DocumentNumber; UnsupportedElements	
SendUri	JobUuid; JobId, DocumentUri; DocumentTicket LastDocument DocumentPassword	DocumentNumber; UnsupportedElements	
SetDocumentElements	JobUuid; JobId ; DocumentNumber; DocumentTicket OperationMode	UnsupportedElements	
SetJobElements	JobUuid; JobId ; JobTicket; OperationMode	UnsupportedElements	
SuspendCurrentJob	JobUuid; JobId;		
ValidateDocumentTicket	DocumentPassword, DocumentTicket	PreferredElements UnsupportedElements	
ValidateJobTicket	JobTicket , DocumentPassword, JobPasswordEncryption, JobPassword	JobId PreferredElements UnsupportedElements	

Note 1: Elements in bold font are mandatory for the associated operation. All Client Requests can include the following Elements.

ElementsNaturalLanguage (if request includes Elements in a Natural Language); Character Set is defined in binding protocol

ElementsNaturalLanguageRequested (if response is to include Element in a Natural Language)

ServiceUuid (target Cloud Service)

RequestingUserName and/or RequestingUserUri (mandatory)

Message(

RequestingUserName (At a minimum, this Element is used by the Cloud Service to determine whether the requestor is authorized to make the request. It is anticipated that, in a Cloud environment, implementations will require further authentication of the requestor's identity using standard security techniques. If the requestor is not determined to have access, the Service rejects the request and, unless security procedures dictate no response, informs the Client of the reason for rejection.)

Note 2: Elements in bold font are mandatory for the associated operation. All Cloud Service Responses can include the following Elements.

ElementsNaturalLanguage (if response includes an Element in a natural language)

OperationStatusCode (mandatory); indicates that operation has been accepted or not and possibly error condition (e.g., Request identifies a System, Service, Job or Document that is not recognized; the Request refers to an inactive Job as though it were active, or there is some error in the received operation request format.)

Message; Cloud Service response text message identifying any error condition and reason

Note 3: Response includes identified but un-cancellable Jobs

4.2.1.1 AddDocumentImages

The AddDocumentImages operation allows a Client to prepare a Service to accept a hardcopy Document via a scanner Subunit and to add it to an identified Job. This operation replaces and is a more general version of the AddHardcopyDocument operation defined in MFD Model and Common Semantics [PWG5108.01]. It is analogous to the SendDocument and SendUri operations which deal with or reference Digital Documents except that AddDocumentImages refers to hardcopy Documents. This operation therefore is applicable to Services such as FaxOut for which input Documents are obtained by a scan of a region of a media sheet side. The AddDocumentImages operation includes InputElements to specify scanning parameters.

The Service rejects this request and sends an appropriate message if:

1. The requestor is not the owner of the identified Job, or is not an Administrator or Operator;
2. The Service has already closed inputs to the identified Job;
3. The Job is not found; or
4. The InputElements values are invalid or unsupported.

Otherwise, provided the request is properly constructed, complete and references valid objects, the Service accepts the request, closes the Job if the LastDocument Element is asserted, and prepares to add Document Data from the identified input to the identified Job, and sends a response to the request.

4.2.1.2 GetNextDocumentData

GetNextDocumentData is a DocumentData flow control operation that can be used when the Client is pulling DocumentData from the Service. When the Client is informed that a Job with a DocumentData output is in the 'processing' or 'completed' state, the Client can send a GetNextDocumentData request. As the DocumentData becomes available, the Service delivers this data in the response, along with the DocumentNumber, indicating the Document within the Job to which the data belongs, and the DocumentFormat value, indicating the file type of the data. If there are multiple Documents in the Job (and therefore multiple files), the document number changes after the previous document transmission is complete. The LastDocument Element is returned with a TRUE value when the transfer of all documents within the Job is complete.

The authenticated Requesting User performing this operation is to be either be the Job Owner or an Operator or Administrator of the Service. Otherwise, the Service rejects the operation, possibly returning an appropriate reason.

4.2.1.2.1 GetNextDocumentData Request

The following Elements are associated with the GetNextDocumentData Request:

1. ElementsNaturalLanguage: (CharacterSet is assumed to be identified in by the transport binding)
2. ServiceUuid: (identify the Service for this operation)
3. JobId (identify the target for this operation)
4. RequestingUserName and RequestingUserUri Elements
5. DocumentDataWait (A TRUE value indicates that the Client wants to block waiting for the response. If not included in the request, the Element value is considered FALSE.

4.2.1.2.2 GetNextDocumentData Response

The Service can respond to a GetNextDocumentData Request as follows:

1. The Service can reject the request and return the ServerErrorBusy status code if the Service is too busy to accept this operation at this time. If the Service rejects the request, it returns a DocumentDataGetInterval value to indicate when the Client can try again.
2. If the Client request does not include a TRUE DocumentDataWait value, the Service immediately returns any available DocumentData of the identified Job along with a DocumentDataGetInterval value indicating when the Client can again send a GetNextDocumentData Request to get additional DocumentData of the identified Job.
3. If the Client request does include a TRUE DocumentDataWait value, and the Service accepts this mode, the Service immediately returns any available DocumentData of the identified Job and continues to return Document Data as it becomes available until all Document Data for the Job has been transferred.
4. If the Client request does include a TRUE DocumentDataWait value, but the Service does not accept this mode or, if once having accepted it, the Service decides to terminate the DocumentDataWait mode at any time, the Service returns a DocumentDataGetInterval value indicating when the Client can again send a GetNextDocumentData Request. This indicates to the Client that the Service has left the DocumentDataWait mode and the number of seconds in the future that the Client can again send the GetNextDocumentData Request. The Client accepts this response.

The following Elements are part of the GetNextDocumentData Response

- a. Status Message: This includes a StatusCode and might include a Status Message or DetailedStatusMessage.
- b. ElementsNaturalLanguage (CharacterSet is assumed to be identified in by the transport binding)
- c. Compression: The value for the compression technique used on the DocumentData
- d. DocumentFormat: The format of the DocumentData

- e. `DocumentDataGetInterval`: The number of seconds before the Client can again send a `GetNextDocumentData` Request.
- f. `LastDocument`: A TRUE value indicates that the `DocumentData` being sent is for the last document in the Job.
- g. `DocumentNumber`: The number of the document in the Client requested Job.
- h. `DocumentData`: The data, or a portion of the data, of the identified document and encoded using the identified Compression.

4.2.1.3 IdentifyDevice

A User can need to physically locate and/or interact with a piece of equipment that they are considering using, or that already contains hardcopy intended for them. The `IdentifyDevice` operation causes a request to be relayed to the appropriate Service that, if it supports this operation, will cause the input or output device associated with the service to generate a visual or audible signal, allowing the User to locate it. The `IdentifyDevice` operation is a generalization of the IPP `Identify-Printer` operation [PWG5100.13] and might include values for the following Elements. Note that Requesting User and possibly more involved User authentication and authorization data is required. All other Elements are optional and will revert to System, Service or Device default values if not supplied:

1. `Target Device`: the `SystemUuid`, and/or `SystemName` values specifying the Target Device that is to provide an `Identify` signal. Note that this is the identity of the local input or output device, not the Cloud Service. In some cases, the Client does not know the identification of the local input or output device of interest, but wishes to have the physical device receiving or producing hardcopy for a particular Job identify itself. In such cases, the operation includes the `JobUuid` and the Imaging System determined the Target Device.
2. `JobUuid`: Used to identify the Target Device when the Client wishes the local input or output device that is handling the indicated Job to identify itself.
3. `Requesting User`: identity of the requesting User (although the Cloud Service will probably already have received and authenticated this information.)
4. `"message"`: a message to the User to be displayed by the Target Device. Supplying this information is optional but, if it is provided, the Cloud Service response indicates whether this capability is supported by the Target Device.
5. `IdentifyActions`: request that desired identify signal be a text display on the Target Device, a flashing light, an audible alert or a spoken message or that any previously requested `IdentifyActions` from this Client be canceled. Supplying this request is optional but, if it is requested, the Cloud Service response indicates whether the requested capability is supported by the Target Device.

4.2.2 Local Imaging System Proxy Operations

In the Client to networked Imaging Service model, operations are initiated by the agent forwarding the Imaging request; i.e., the Client sends requests to a Service and the Service can send requests to a subordinate Service to which it has network access, such

as one in an MFD. However, in the Cloud Imaging Model, it is likely that a Cloud Imaging Service is isolated from the Local Imaging Service by a firewall and cannot initiate requests. Therefore, an alternate set of operations is used by the Local Imaging System Proxy to get Imaging Job information from and provide Local Imaging Service and Job status to the Cloud Imaging Service.

Some of these operations are corollaries of the basic Client-Service Imaging operations, with the operation issued by the Local Imaging System Proxy prompting a response from the Cloud Service that is the same in content and perhaps form to a Client Operation sent to a Service. On receiving this response from the Cloud Service, the Local Imaging System Proxy sends a message to the Cloud Service that corresponds to the response a Service would send back to the Client. For example, the response to a FetchJob request is equivalent to a CreateJob request; the subsequent AcknowledgeJob request is equivalent to the response to a CreateJob request.

The following characteristics of the model are to be observed in understanding these operation descriptions.

1. All Operations are in a request/response form with the request sent by the Local Imaging System Proxy and the response sent by the Cloud Imaging Service. The protocol used assures correlation of request to response. The content of requests and responses typically is reversed compared to analogous operations in Client to Service Imaging model.
2. Proxy Operations can be requests for the Cloud System to supply some information in its response (e.g., GetFetchableJobs, FetchJob), or they can be information that the Proxy is volunteering (e.g., UpdateJobStatus, AcknowledgeJob). In either case, the Cloud Service can respond with error or other information messages. Errors can refer to structure or contents of message (e.g., necessary information not provided)
3. The Local Imaging System Proxy can interface with multiple Cloud Imaging Services.
4. A Cloud Imaging Service can accept messages from multiple Local Imaging System Proxies (but keeps communications with each separate.)
5. The protocols used by the Local Imaging System Proxy in initiating requests to the Cloud Imaging Service provide for the identification and authentication of the Local Imaging System Proxy, as well supporting security requirements appropriate to the use of the Cloud Imaging facility.
6. Local Imaging System Proxies can front-end multiple Services in multiple Local Imaging Systems. A Local Imaging System Proxy can report capabilities and status values for each Service individually; or it can report capabilities and status values which are an intersection or a union of capabilities and status of the Services it represents. In the former case, the Cloud-accessible capabilities of each local imaging Service are reported to the linked Cloud Imaging Service and a specific Service is selected by the User. In the latter case, the Proxy reports on a composite service of a given type and the linked Cloud Imaging Service has no knowledge of capabilities of the individual Local

Services. In this case, the Local Imaging System Proxy schedules Jobs and maps Jobs to Local Imaging Services based on Job requirements versus local policy and individual Service capability and state.

Table 4 - The Local Imaging System Proxy to Cloud Imaging Service Operations

Operation	Request Parameters (Note 1)	Response Parameters (Note 2)	Note
AcknowledgeDocument	JobId ; JobUuid; DocumentNumber or DocumentUuid FetchStatusCode UnsupportedElements ImpressionsCompleted DocumentState DocumentStateReasons		3
AcknowledgeJob	JobId ; JobUuid FetchStatusCode UnsupportedElements ImpressionsCompleted JobState JobStateReasons		3
DeregisterSystem	Message		4
FetchDocument	JobId ; JobUuid DocumentNumber or DocumentUuid CompressionAccepted DocumentFormatAccepted	DocumentNumber or DocumentUuid DocumentFormat; CompressionSupplied; DocumentTicket LastDocument DocumentMessage DocumentPassword DocumentData or DocumentUri or InputElements (for FaxOut)	3, 6
FetchJob	JobId , JobUuid	JobTicket; JobPassword JobPasswordEncryption, JobTicket DestinationUris (for Scan and FaxOut) DestinationAccesses (for Scan) InputElements (for Scan)	3,7
GetFetchableJobs		List of JobId , JobUuid; Job summary collection (Copies, Finishings, Impressions, KOctets, Media MediaType, MediaCol, SourceJobUuid, other Elements)	3
GetJobDocumentElements	JobId , JobUuid DocumentNumber , DocumentUuid; RequestedElements	Document (DocumentReceipt, DocumentStatus, DocumentTicket) UnsupportedElements	3
GetJobDocuments	limit FirstIndex JobId , JobUuid RequestedElements	Documents(list of DocumentSummaries) JobId , JobName UnsupportedElements	3
GetJobElements	JobId ; JobUuid RequestedElements (JobReceipt, JobStatus, or JobTicket.)	Job ((JobReceipt, JobStatus, JobTicket.)ElementsNaturalLanguage UnsupportedElements	3
GetServiceNotifications	ServiceState(Local Service); IdentifyDeviceState	ServiceState (Cloud Service) TimeoutError RegistrationSuspended JobFetchable; JobTerminated; IdentifyActions	3,4

Operation	Request Parameters (Note 1)	Response Parameters (Note 2)	Note
RegisterSystem	Elements of Local Imaging System to be registered or re-registered: CharsetConfigured, NaturalLanguageConfigured, MakeAndModel, OwnerUri, SystemGeoLocation, SystemLocation, SystemName, ConfiguredServices, SystemUuid State StateMessages ResourceKOctetsRequested	ServiceUuids of Cloud Services corresponding to identified ConfiguredServices in Local System(s) ResourceDirectoryUri: ResourceKOctetsSupported: ResourceKOctetsFree	4,5,8
UpdateActiveJobs	List of JobUuids with States	List of JobUuids with States (if disagree with request data)	3
UpdateDocumentStatus	DocumentStatusElements		3
UpdateJobStatus	JobTable (listing by Job of JobId, JobUuid and selected JobStatus Elements [e.g., <u>ImpressionsCompleted</u> , or <u>ImagesCompleted</u> <u>JobState</u> , <u>JobStateReasons</u> , <u>DetailedStatusMessages</u>])		3
UpdateServiceElements	(all below relative to Proxied Local Service) CharsetConfigured, NaturalLanguageConfigured, , ServiceName, ServiceUuid ServiceState, ServiceStateReasons, IsAcceptingJobs		3, 5
UpdateSystemElements	List of Changed System Elements and Values State StateReasons StateMessages		5
UploadJobDocumentData	JobId ; JobUuid DocumentNumber or DocumentUuid DocumentFormat; CompressionSupplied; DocumentData; DocumentMessage		3

Note 1: Elements in bold font are mandatory for the associated operation. All Cloud Model Proxy Requests can include the following Elements.

ElementsNaturalLanguage (if request includes Elements in a Natural Language); Character Set defined in binding protocol

ElementsNaturalLanguageRequested (if response includes an Element in a natural language); ServiceUuid (target Cloud Service);

LocalServiceUuid (Proxied Local Service) (mandatory);

RequestingUserName and/or; RequestingUserUri (mandatory) (RequestingUser is the Proxy)

The RequestingUserName, can be used by the target Service to determine whether the requestor is authorized to make the request. Some implementations can require further authentication of the requestor's identity. If the requestor is determined to not have access, the Service rejects the request (unless security procedures dictate no response.)

Note 2: Elements in bold font are mandatory for the associated operation. All Cloud Model Proxy Operation Responses can include the following Elements:

ElementsNaturalLanguage and ElementsCharacterSet(if response includes an Element in a natural language)
OperationStatusCode (mandatory); indicates that operation has been accepted or not and possibly error condition (e.g., Request identifies a System, Service, Job or Document that is not recognized; the Request refers to an inactive Job as though it were active, or there is some error in the received operation request format.)
Message; Cloud Service response text message identifying any error condition and reason

Note 3: Sent to a specific Cloud Imaging Service on behalf of a specific Local Imaging Service

Note 4: Sent to the Cloud System Control Service by the Local Imaging System Proxy on behalf of a Local Imaging System

Note 5: In conjunction with System registration, these operations are sent on behalf of all Local Services to be made accessible via the corresponding Cloud Service to specify the accessible characteristics of the Local Service. Thereafter, this operation is used to update values of previously identified Elements.

Note 6: The FetchDocument response can address the DocumentData in various ways. For example, if DocumentData is to be sent to the Local Service as for a Print Job, the Document data itself may be supplied (DocumentData) or a reference to where the DocumentData can be accessed can be returned (DocumentUri). If the Local Service is to supply the DocumentData for a FaxOut Job, InputElements defining scan parameters are returned. There is no FetchDocument request for a Scan Job.

Note 7: If the Local Service is to supply DocumentData as for a Scan Job, the FetchJob response includes the scanning parameters (InputElements) and the data destination(s) (DestinationUris) and destination access information (DestinationAccesses). By the Semantic Model, the Destination complex Element identifies where the output of the Job is to be delivered and may be either a directory in which the Digital Document is to be stored or the URI to the Digital Document file.

Note 8: Cloud Imaging System returns Resource information only if Resource Directory is supported.

4.2.2.1 AcknowledgeDocument

The AcknowledgeDocument operation is sent by the Local Imaging System Proxy after the Cloud Imaging Service response to the FetchDocument has been received. The operation informs the Cloud Service of the acceptance (or rejection) of the Document. The AcknowledgeDocument operation request is analogous to the response to a SendDocument, SendUri or AddDocumentImages Client Operation. The operation identifies the Job and Document UUIDs. The FetchStatusCode indicates the success (or failure) of the Local Imaging Service in accepting the Document.

The Cloud Imaging Service response to this message serves to confirm that the Acknowledge Imaging Document message was received, as well as to inform the Local Imaging System Proxy of any error caused by an externally prompted state change (e.g., a Client Job Cancel) or inconsistency in the message (e.g., reference to a non-existent or not available Document.)

4.2.2.2 AcknowledgeJob

The AcknowledgeJob operation informs the Cloud Service that the Proxy has received the Job (and presumably has sent it on to the Local Service.) The operation request is analogous to the response to a CreateJob operation in a Client - Networked Imaging Service model. The AcknowledgeJob operation provides the JobUuid, a FetchStatusCode indicating the success (or failure) of the Local Imaging Service in accepting the Job, and identifies any locally UnsupportedElements. If the Local Service rejects the Job, this is indicated by the appropriate FetchStatusCode along with an appropriate Message (if available).

On receipt of the AcknowledgeJob, the Cloud Service removes the Job from the FetchableJob list for the responding Local Service. Provided that the FetchStatusCode does not indicate that the Job has been rejected, the Cloud Service also removes the Job from the FetchableJob list for any other Local Service.

The Cloud Imaging Service response to this message confirms that the AcknowledgeJob message was received, and informs the Local Imaging System Proxy of any error caused by an externally prompted Job state change (e.g., a Client Job Cancel) or inconsistency in the message (e.g., reference to a non-existent or not available Job.)

4.2.2.3 DeregisterSystem

If the Owner of a Local Imaging System that has been registered with a Cloud Imaging System wishes to terminate or suspend the accessibility of all Local Imaging System Imaging Services, he will instruct the Local Imaging System Proxy for the System to send a DeregisterSystem request to the appropriate Cloud System Control Service. This message causes the Cloud Imaging System Control Service to terminate User accessibility through its Imaging Services with the Local Imaging System and its Imaging Services. Note that, at this point, the Cloud Imaging Control System will retain the information about the deregistered Local Imaging System that was provided by the Cloud Imaging System Owner to allow Local System re-registration, as well as any Job and usage statistics accumulated relative to Local System Imaging services.

The response to this request will acknowledge receipt. The request can be rejected if there are errors in form or content, but not for any other reason. Unless the request was rejected, any transactions in process between the Cloud Service and the Proxy on behalf of any Services in the deregistered Local Imaging System will be aborted. If the Cloud Service has any active Jobs with Services in the deregistered Local Imaging System, it reports the resulting Job State change to the appropriate Client. Such Jobs can be re-routed or aborted by the Cloud Imaging Service, or canceled by the Client. Note that the DeregisterSystem operation does not directly affect the relationship between the Local Imaging System Proxy and the Cloud Imaging System Services, and other message transactions in process can continue to completion.

The Deregister operation is primarily intended to terminate a Cloud-Local relationship, although administrative operations to both Proxy and Cloud System Control Service can

be necessary to finalize the termination. As long as the Proxy communication with Cloud System Imaging Services is possible, temporary suspensions, such as for maintenance actions on a Local Imaging System, can be communicated by sending an Offline status update for the Local Imaging System

4.2.2.4 FetchDocument

After the Local Imaging System Proxy has accepted a Job, it eventually needs specific information about the Document(s) in that Job. For Service types in which the Document data is supplied to the Local Imaging Service, the Local Imaging System Proxy FetchDocument operation obtains the DocumentData or DocumentUri reference along with operational Elements from the Cloud Service. In addition to Print Service Jobs, this could include FaxOut Service Jobs where the Document Data is supplied by the Cloud Service and the facsimile is output by the Local Service. For FaxOut Jobs in which the Local Service provides Document Data to the Cloud Imaging Service identified destination, the Local Imaging System Proxy FetchDocument operation obtains InputElements defining the scan parameters for hardcopy Documents.

The FetchDocument request includes the Job and Document identification corresponding to the information received in response to the FetchJobs operation. In the case of FetchDocument operations for Services in which the Document Data is going to the Local Imaging Service, the Operation can optionally identify the DocumentFormatAccepted and CompressionAccepted for the destination Local Service. These “accepted” Elements are complete or subsets of the DocumentFormatSupported and CompressionSupported Service Description Elements provided in the UpdateServiceElements operation, but are ordered with respect to Service preference at that time and possibly with respect to the Document to be fetched. For example, if the AcknowledgeDocument request in response to a previous FetchDocument operation for the same Document indicated that the Document had not been accepted, possibly because it was a PDF Document with features not supported by the Local Service, the Proxy might send a follow up FetchDocument request with DocumentFormatAccepted listing PWG Raster as the first choice and not including PDF.

The FetchDocument response corresponds to the request portion of the Client SendDocument or SendUri operation for Imaging Services in which the Document Data is consumed by the Local Imaging Service. The FetchDocument. response corresponds to the request portion of the Client AddDocumentImages operation for Imaging Services in which the DocumentData is supplied by the Local Imaging Service. If supported, a DocumentTicket can also be returned.

4.2.2.5 FetchJob

Once the Local Imaging System Proxy has received a response to a GetFetchableJobs request identifying one or more Jobs waiting for a particular Local Imaging Service, it sends a FetchJob request to the corresponding Cloud Imaging Service. This request includes the Cloud Imaging Service Job UUID reported in the GetFetchableJobs response

which corresponds to a Job that the Local Imaging System Proxy intends to receive and direct to the Local Imaging Service.

The FetchJob response is analogous to a CreateJob request. This response includes the operational attributes of the CreateJob request (e.g., RequestingUserName of the Job originator, JobPassword) as well as the Job's ImagingJobTicket information. It does not include either the Document Data or a reference to Document Data; for Imaging Services other than Scan, the Local Imaging System Proxy issues a FetchDocument message to get this data. There is no FetchDocument request for a Scan Job.

The FetchJob response for a Scan Job includes InputElements, defining how the Local Service is to scan the hardcopy, and the image data DestinationUris and DestinationAccesses Elements. The Destination Uris Element may be multivalued (if the scanned image data is to be sent to multiple locations. The DestinationAccesses complex Element contains authentication information for a referenced Document. Each DestinationAccesses Element value contains zero or more child Elements which provide the authentication information required for the Document.

The FetchJob response for a FaxOut Job also includes a Destination Element, which may be multivalued, but does not include DestinationAccesses (because Fax destinations do not normally require user authentication) nor InputElements (which are supplied in response to a FetchDocument request).

The Cloud Imaging Service response includes a status code and optionally a message for the operation. This would include error information if the identified Job is unknown or is not available to be fetched by the Proxy for the indicated Local Service. Note that a Proxy is only allowed to fetch Jobs that have been offered to it in a GetFetchableJobs response and further that a Cloud Service can make an offered Job non-fetchable for a particular Local Service at any time before the Job has been fetched. Once a Cloud Imaging Service receives an AcknowledgeJob request indicating that a Proxy has accepted a Job on behalf of a Local Imaging Service, the Cloud Service makes that Job non-fetchable to that Local Imaging Service.

4.2.2.6 GetFetchableJobs

GetFetchableJobs is sent by the Local Imaging System Proxy on behalf of each registered Local Imaging Service to the Cloud Service with which that Local Service is linked, to request the list of Jobs that are ready to be fetched for processing by that Local Service.

The Model accommodates implementations ranging from Cloud Services that just channel Jobs to Local Services to those which just use the input/output device capabilities of the Local Service. Therefore, the criteria that will cause a Cloud Service to report a Job fetchable by a Proxy for a specific Local Service are out of scope (although, for Jobs involving Document fetch, it is desirable that the Document Data be available.) However, unless canceled or aborted, a Job reported fetchable will remain fetchable until the Cloud Service receives an AcknowledgeJob message for that Job on behalf of a Local Service for which the Job has been fetched in response to a FetchJob message.

The Local Imaging System Proxy will use the response to the GetFetchableJobs request to identify the requested Job in its subsequent FetchJob request. The Local Imaging System Proxy sends a GetFetchableJobs message on behalf of a Local Imaging Service whenever that service has remaining capacity for new Cloud-supplied Jobs and the GetServiceNotifications response (or other notification mechanism) has indicated fetchable Job(s) exist for that Local Service.

The operation can accommodate Job scheduling at either the Cloud Imaging Service or the Local Imaging System Proxy. When the Cloud Imaging Service is handling Job scheduling, the Cloud Imaging Service will return a list identifying at most a single Job. The Job is identified by its JobUuid in the Cloud Imaging Service. If the Local Imaging System Proxy (or the Imaging Service) does Job scheduling, the Cloud Imaging Service response is a list of fetchable Jobs. The Proxy can then issue GetJobElements requests for the identified Jobs to get Job specific information useful for scheduling (e.g., Finishings, Media, ImagingColorModeType, Sides).

If it does not have any fetchable Jobs for the identified Local Service or if there is an error in content or form of the request, the Cloud Imaging Service will respond with an empty list and an appropriate OperationStatusCode.

4.2.2.7 GetJobDocuments

For scheduling purposes, a Local Imaging System Proxy or the Local Service it represents can need to know more about the Documents contained in a particular Job that has been accepted before it fetches the Document(s). This can be to get information to sequence the processing of Jobs or the processing of multiple Documents within a Job. The GetJobDocuments operation is similar to the Client GetDocuments operation, except that the Proxy can access Document information only for Jobs that have been offered to and accepted by the identified Local Service. The Cloud Service returns identification of all Documents in the specified Job along with Elements that are in the corresponding Document Ticket.

4.2.2.8 GetJobDocumentElements

The GetJobDocumentElements operation allows a Local Imaging System Proxy to obtain detailed information about the specified Document within the specified Job. This operation is identical in form, content and desired response to the Client GetDocumentElements operation, except that the Proxy can access Document Element information only for Documents in Jobs that the Proxy has fetched on behalf of the identified Local Service.

The Proxy requests specific groups of Elements (complex Elements) contained within the Document. The Document Data is not part of the Document Elements and cannot be retrieved using this operation. However the location of the Document Data is available. The allowed values for Requested Elements are DocumentStatus and DocumentTicket. Vendors can extend the allowed values.

The Cloud Service returns the DocumentDescription Element values that the originating Client supplied in the Document Creation operation (CreateJob, SendDocument or SendURI) or provided in SetDocumentElements operation, plus any additional DocumentDescription Elements that the Service has generated, such as DocumentState. The Service does not return any JobElements that the Document inherits from the Job level but does return DocumentElements specified at the Document level. A specific Document might not include all Elements belonging to a group because some Elements are optional.

4.2.2.9 GetJobElements

The GetJobElements operation allows the Proxy to obtain detailed information on the Job by its JobUuid. The GetJobElements request does not specify individual Elements. Rather, the Proxy requests specific groups of Elements contained within the Job. The allowed values for RequestedElements are JobReceipt, JobStatus, or JobTicket. Vendors can extend the allowed values.

This operation is identical in form, content and desired response to the Client GetJobElements operation, except that the Proxy can access JobElements only in Jobs that the Proxy has fetched on behalf of the identified Local Service. The GetJobElements operation is used by the Proxy when the Proxy, or some other Local agent, requires information on Jobs that the Proxy has fetched.

The Cloud Imaging Service responds with an OperationStatusCode which indicates an error if the Cloud Service does not recognize the identified Job as one that was fetched by the Proxy and which the Proxy acknowledged receiving.

4.2.2.10 GetServiceNotifications

The GetServiceNotifications message is sent periodically from the Local Imaging System Proxy to each Cloud Imaging Service and to the Cloud System Control Service to maintain communication, to inform the Cloud Service of the Local Service state, and to allow the Cloud Imaging Service to notify the Local Imaging System Proxy of some necessary impending activity for Proxy. (e.g., Proxy to re-register a Local System or to send a GetFetchableJobs or UpdateActiveJobs). Unlike most of the other Proxy-to-Cloud operations, GetServiceNotifications does not follow the form or content of a response to an Imaging Client operation.

It is possible that other mechanisms could be used to check whether there is a Cloud Service operability or a communications problem. Also, asynchronous notification initiated by the Cloud Imaging Services could be used to alert the Local Imaging System Proxy of Cloud Service status. To the extent that these alternate mechanisms are present and provide the information defined to be in the responses to GetServiceNotifications, they might reasonably allow significant reduction in the frequency in which GetServiceNotifications messages are sent without affecting reliability or increasing Job handling latency.

4.2.2.10.1 GetServiceNotifications Request

The GetServiceNotifications request contains:

1. The identification (ServiceUuid) and state (ServiceState) of the Local Service,
2. IdentifyDeviceState, indicating the state of the Identify Device signal with respect to a previous IdentifyActions request from that Cloud Service, specifically whether the latest request:
 - a. is being signaled (1),
 - b. was denied (2),
 - c. was terminated (3), or
 - d. the Identify signaling is busy with a request from some other source (4).

4.2.2.10.2 GetServiceNotifications Response

The response to this message includes:

1. Cloud Service/System Status: UUID and summary status of the Cloud Imaging Service, or in the case of a Cloud System Control Service response, summary status of the System including the identification and state of each Cloud Imaging Service in the System.
2. TimeoutError: The Cloud Service has not received a message relating to the identified Service in a significant time and there may be a synchronization loss. This response requests the Proxy to do full update operations for the Local Imaging Service and an UpdateActiveJobs for that Local Service. If this is a response from the Cloud System Control Service, the updates should be for the System and for all Local Services and their untermiated Jobs derived from an Imaging Service in that Cloud System.
3. RegistrationSuspended: The Cloud System Control Service has timed out waiting for a GetServiceNotifications messages from the Local Imaging System Proxy (or for some other reason) and has suspended all System registrations handled by that Proxy. Or the Cloud System Control Service, acting on behalf of the Cloud Imaging System needs to re-characterize Local Imaging System registration. To resume Cloud support, the Proxy resubmits all System registrations and Service initializations. The Local Imaging System Proxy recovers Job synchronization by sending UpdateActiveJobs for all Local Services after re-registration and Service Update.
4. RegistrationTerminated: The Cloud Imaging System has terminated its relationship with the Local Imaging System and will not accept a re-registration. (This might be used to discontinue communication with a problematic Proxy.)
5. IdentifyActions: A parameter requesting that the identified Target Device generate a visual or audible signal, allowing a requesting User to locate it. This request, if present, specifies the requesting User and the desired type of signal:
 - a. Do Nothing: (0)

- b. Display: Displays the default a Client-provided message; if the message is provided, it is limited in length and is in a natural language and character set supported by the Target Device. (1)
- c. Flash: Flashes lights or the display. (2)
- d. Sound: Makes a sound. (3)
- e. Speak: Speaks the default or Client-provided message; if the message is provided, it is limited in length and is in a natural language and character set supported by the Target Device. (4)
- f. Cancel: end signaling previously requested for this User. (5)

The Cloud System Control Service will previously have determined what identify signaling is supported by the Target Device, and will not request a signal type of which the Target Device is incapable. The Target Device can automatically end any requested Device Identify signal, can have this capability disabled, or can be honoring a request from some other source; the state of satisfaction of a DeviceIdentifyRequest from a given Cloud Imaging Control Service is reported in the subsequent GetServiceNotifications message to that Cloud Imaging Service.

In addition, responses from Cloud Services other than the Cloud System Control Service can include the following Job-related Elements.

- 6. JobFetchable: An Element indicating that the Cloud Imaging Service has one or more fetchable Jobs. The Local Imaging System Proxy is to respond with a GetFetchableJobs message (only in responses for Local Imaging Services).
- 7. JobTerminated: One or more Elements, each containing a JobUuid and the state of that Job, indicating that the identified, previously fetched but locally presumed still active Jobs has been terminated in the Cloud Service (only in responses for Local Imaging Services).

4.2.2.11 RegisterSystem

On Registration, the Local Imaging System Proxy sends a RegisterSystem message for each Local Imaging System that is to be registered to the corresponding Cloud Imaging System Control Service. This message identifies the System Elements (PWG Semantic Model Elements directly under Description and Status) that are to be made known to the Cloud Imaging System, along with their current values. This set of Elements includes Local Imaging Services to be made accessible to the Imaging Services of the Cloud Imaging System and constitutes the proposed Accessible System Element set for the Local Imaging System. The response from the Cloud Imaging System Control Service acknowledges receipt of the message and reports any errors.

If there are any Elements in the proposed Accessible System Element set that the Cloud System Control Service is to ignore, it identifies these in its response as not supported. That is, the Cloud Imaging System Control Service has the option of ignoring some reported Local Imaging System Elements. Alternatively, the Cloud Imaging System Control Service can send an error rejecting the Local Imaging System entirely or the Proxy cannot accept the reduced Accessible System Element set. In either such case, the Local Imaging

System is not registered with the Cloud Imaging System. In out-of-band consultations, the Local System Owner can seek to resolve the problem with the Cloud System Owner. The resolution can be to register the Local Imaging System with a modified proposed Accessible System Element set.

The proposed Accessible System Element set, possibly with reported not (Cloud) supported Elements removed, if accepted by the Proxy, constitutes the Registered System Element Set for the Local Imaging System.

This RegisterSystem message follows the form of the response to a Client-issued GetSystemElements message, where the Elements included are those which the Local Imaging System Owner intends to make accessible to the Cloud Imaging System.

If the Registered System Element Set is to be changed (i.e., Elements to be added or removed), a new RegisterSystem message is sent with the revised set of Elements and their values.

4.2.2.12 UpdateActiveJobs.

After a Job “Fetch” has been confirmed by an AcknowledgeJob operation, the Local Imaging System Proxy sends UpdateJobStatus messages to communicate Job State changes in each Local Imaging Service. However, a service disruption in the Local Imaging Service, the Proxy or in communication with the Cloud Imaging Service; or a change to the state of a Job prompted by the Client or some other “Upstream” activity can result in Cloud and Local Job states to be different. To correct this, the Local Imaging System Proxy sends an UpdateActiveJobs message. This message identifies all Active Jobs in an identified Local Imaging Service; i.e., Jobs that the Local Imaging System Proxy is aware that it has fetched and has acknowledged or has intended to acknowledge, but not including Jobs for which the Local Imaging System Proxy has sent and the Cloud Imaging Service has acknowledged an UpdateJobStatus message indicating that the Job is in a terminating state. Note that UpdateActiveJobs includes Jobs which the Proxy considers in a terminated state but for which a response to the UpdateJobStatus indicating this terminated state has not been received. The message includes the current states of these Jobs. The Cloud Service either resolves the state of all Jobs which it believes have been fetched by the Proxy for each identified Local Service, or returns a message requiring the Proxy to resolve the Job status.

Table 5 identifies actions in response to an UpdateActiveJobs. Active Jobs from the Cloud viewpoint are Jobs which have been acknowledged as being fetched (AcknowledgeJob received) but for which an UpdateJobStatus message indicating a Job termination state has not been received. Active Jobs from the Proxy viewpoint are Jobs which have been acknowledged as being fetched (response to AcknowledgeJob received) but for which an UpdateJobStatus message indicating a Job termination state has not been sent.

Table 5 - Resolution of Disparate Job Status in Response to UpdateActiveJobs

Cloud Job Fetchability	Proxy Reports in UpdateActiveJobs	Action
Job not fetched for identified Local Service (or not recognized)	Job Not Listed	none
	Job Listed for Local Service	Cloud reports error, identifying Jobs listed in UpdateActiveJobs which are invalid. Proxy removes Jobs from Active Jobs list .
Job Fetched & Active in identified Local Service	Job Listed for Local Service	Cloud aligns Job State with Proxy reported Job state
	Job Not Listed for the same Local Service	Cloud makes Job fetchable for appropriate Local Service
Job Fetched but in Terminated State	Job Not Listed or listed in terminated state	none
	Job Listed for the same Local Service but not in terminated state	Cloud reports error and identifies Jobs listed as not terminated in UpdateActiveJobs operation for given Local Imaging Service along with their terminated state. Proxy aligns its state for such Jobs.

An UpdateActiveJobs message for each Service supported is sent by the Local Imaging System Proxy when the Proxy senses that communication with the Cloud Imaging Service has been restored after a disruption, when requested by the Cloud Service, after any hard reset, and after power-up initialization of the Proxy or a supported Local Imaging Service.

An UpdateActiveJobs message for a specific Service is also sent by the Local Imaging System Proxy when the message in response to a FetchJob, AcknowledgeJob, UpdateJobStatus, FetchDocument, AcknowledgeDocument, UpdateDocumentStatus, GetJobElements or UploadJobDocumentData operation indicates an unrecognized Job UUID.

4.2.2.13 UpdateDocumentStatus

The Local Imaging System Proxy sends this message reporting the current status of an identified Document, along with state message and reasons, whenever the status of that Document changes. The Document status in the Local Imaging System Proxy considers the status of the corresponding Job and Document in the Local Imaging Service to which the Job was directed. In some cases, as when the Local Imaging System Proxy is doing preprocessing or acquisition of referenced Document Data , Document status can be determined by the Local Imaging System Proxy rather than the Local Imaging Service.

The Cloud Imaging Service response reports successful receipt of the update or a message indicating an error in the form or content of the request. For example, a Document Identification error indicates that the Document being updated was not considered to be active in the indicated Local Imaging Service either because it had not been acknowledged as fetched for that Local Service or because it was in a terminated Job.

4.2.2.14 UpdateJobStatus

The Local Imaging System Proxy sends an UpdateJobStatus request reporting the current status of an identified Imaging Job, along with state message and reasons, whenever the status of that Job changes. The Job status in the Local Imaging System Proxy considers the status of the Job in the Local Imaging Service to which it was directed. The operation includes a sparsely populated object of the appropriate type. For example, if the Local Imaging Service completes a Job, the UpdateJobStatus message would contain the Elements in the Local Imaging Service JobStatus that have been changed and a final version of the Local Imaging Service JobReceipt.

The Cloud Imaging Service response reports successful receipt of the update or an error in the form or content of the message. For example, an error message might indicate that the Job being updated was not considered to be an ActiveJob in the identified Local Imaging Service either because it had not been acknowledged as fetched for that Local Service or because it was in a terminated state.

4.2.2.15 UpdateServiceElements

After the System has been registered, the Local Imaging System Proxy sends an initial UpdateServiceElements message to the corresponding Cloud Imaging Service for each Local Service to be made accessible. This initial UpdateServiceElements identifies the Local Service Elements (Elements under CapabilitesReady, Defaults, Description and Status) that are to be made known to the Cloud Service, along with their values.

This initial message follows the form of the response to a Client-issued GetServiceElements message, but rather than providing information on Elements requested by the Client, the Elements included are all those to be made accessible to the Cloud Imaging Service. This constitutes the proposed Accessible Service Element set for the Local Service. The response from the Cloud Imaging Service acknowledges receipt of the message and reports any errors.

If there are any Elements in the proposed Accessible Service Element set that the Cloud Service intends to ignore, it identifies these in its response as not supported. That is, the Cloud Imaging Service has the option of ignoring some reported Local Imaging Service Elements. Alternatively, the Cloud Imaging Service can send an error rejecting the Local Imaging Service entirely or the Proxy could act to not accept the reduced Accessible Service Element set. In either such case the Proxy deregisters the Local System. In out-of-band consultations, the Local System Owner can seek to resolve the problem with the Cloud System Owner. The resolution can be to decide to re-register the Local Imaging System without the rejected Service, or with the Service and a modified proposed Accessible Service Element set.

The proposed Accessible Service Element set, possibly with reported not (Cloud) supported Elements removed, if accepted by the Proxy, constitutes the Accessible Service Element set for the Local Imaging Service.

If the Accessible Service Element set is to be changed for a Local Imaging Service (i.e., Elements to be added or removed), the Local Imaging System Proxy re-registers the Local Imaging System containing that Local Imaging Service and issue new initial UpdateServiceElements messages for all Local Services in that System with the revised set of Elements and their values.

Once the Local Imaging System Proxy has sent the initial UpdateServiceElements to communicate the Accessible Service Element set to the corresponding Cloud Imaging Service, an UpdateServiceElements message is sent to update the corresponding Cloud Imaging Service with any change in value of these Elements.

4.2.2.16 UpdateSystemElements

After registration, an UpdateSystemElements message is sent by the Local Imaging System Proxy to update the value of any Element in the Registered System Element Set. Typically, this will be reporting current System state whenever its state changes, along with state message and reasons. The Cloud Imaging System Service response is an acknowledgment of message receipt.

These UpdateSystemElements messages follow the form of the response to a Client-issued GetSystemElements message, where the Elements included are members of the Registered System Element set the values of which have changed since SystemRegistration or the last acknowledged UpdateSystemElements message.

4.2.2.17 UploadJobDocumentData.

The Local Imaging System Proxy sends a message containing the Document Data that a Local Imaging Service has obtained in executing a Job which requires that the Local Imaging Service output Digital Document Data back to the Cloud Imaging Service, as for when the specified data destination for a Scan Job is not directly accessible to the Local Imaging System Proxy or the Local Imaging Service.

The message includes the JobUuid. The response from the Cloud Imaging Service acknowledges receipt of the data and can include error messages as appropriate.

4.2.3 Cloud Service Management Operations

Administrative Service operations are sent from a Client to a specific Cloud Imaging Service and directly affect only the specific addressed Service within Cloud Imaging System and/or affect the Jobs within the Service. Access is reserved for Administrators or Operators. The Administrative Service Operations are identical to the Administrative Service Operations described in MFD Model and Common Semantics [PWG5108.01], with the addition of GetLocalServices, and GetLocalServiceElements. These additional operations allow administrative identification of the Local Imaging Service(s) accessible to the Cloud Service being queried (a Cloud Service can have access to more than one Local Service), and an administrative view of Elements of each such Local Service.

The Administrative Service Operations for Cloud Imaging Services are listed in Table 6, with paragraphs 4.2.3.1 and 4.2.3.2 describing the GetLocalServices and GetLocalServiceElements operations.

Note that Cloud Service Management operations are accessible to only Users with proper administrative access rights to the Cloud Imaging Service. These operations do not directly affect downstream Cloud Imaging Services, Local Imaging System Proxy(s) which connect to the Cloud Imaging Service, or the Local Imaging Services with which these the Local Imaging System Proxy(s) interface.

Table 6 Imaging Service Specific Administrative Operations

Operation	Request Parameters (Note 1, 2)	Response Parameters (Note 3)	Notes
CancelJobs	JobIds	JobIds	4
DisableService			5
EnableService		-	5
GetLocalServiceElements	LocalServiceUuid; RequestedElements; FirstIndex; Limit	LocalServiceUuid; ServiceElements, Unsupported Elements	
GetLocalServices		List of (LocalServiceUuid, ServiceName, ServiceType)	
HoldNewJobs	JobHoldUntil, JobHoldUntilTime		
PauseService			5
PauseServiceAfterCurrentJob			5
PromoteJob	JobId ; PredecessorJobId		
ReleaseHeldJobs			
ReleaseNewJobs			
RestartService	IsAcceptingJobs; StartServicePaused		
ResumeJob	JobId		
ResumeService			
SetServiceElements	ServiceElements(DefaultJobTicket, ServiceCapabilities, ServiceCapabilitiesReady, ServiceDescription); OperationMode	Unsupported Elements	6
ShutdownService			5, 7

Note 1: Elements in bold font are mandatory for the associated operation. All Client Administrative Requests can include the following Elements

- ElementsNaturalLanguageRequested;
- ServiceUuid (target Cloud Service);
- RequestingUserName and/orRequestingUserUri (mandatory) the RequestingUser is the Administrator;
- Message

Note 2: The RequestingUserName can be used by the target Service to determine whether the requestor is authorized to make the request. Some implementations can require further authentication of the requestor's identity. If the requestor is not determined to have access, the Service rejects the request (unless security procedures dictate no response.)

Note 3: All Cloud Imaging Service Responses correlate to the Request and can include the following Elements.:

ElementsNaturalLanguage(if response includes Element(s) in natural language);
OperationStatusCode(mandatory): indicates that operation has been accepted or not and possibly an error condition (e.g., Request identifies a System, Service, Job or Document that is not recognized; the Request refers to an inactive Job as though it were active, or there is some error in the received operation request format.)
Message:Cloud Service response text message identifying the error condition and reason

Note 4: CancelJobs response includes identified but un-cancellable Jobs with Job States after operation implemented.

Note 5: Operations manage just the addressed Cloud Service, not the associated Local Service(s). However, these operations can render the Cloud Service in a state where it does not respond to Proxy Operations.

Note 6: The Service Elements of a Cloud Imaging Service can depend on the accessible Service Elements of Proxied Local Services with which it communicates. In no case can this SetServiceElements Operation add to the Elements made accessible via Proxies, although it can cause the Cloud Imaging Service to ignore some accessible Elements or Element values.

Note 7: Forcing Service Shutdown can also force the state of any active Jobs to Aborted.

4.2.3.1 GetLocalServices

The GetLocalServices operation directed to a Cloud Imaging Service allows an authorized Client to get the name,type and LocalServiceUids of all Local Services with which the Cloud Imaging Service is (or should be) communicating (via one or more Local Imaging System Proxies). This communication relationship is established by virtue of the registration of Local Imaging System(s) containing that Local Service(s) with the Cloud Imaging System containing the addressed Cloud Imaging Service. Local Services are listed even if the Local Service is Offline or the local System registration has been suspended, but not once the local System has been deregistered. The GetLocalServices response includes only Service identification information rather than the full ServiceSummary provided in response to a ListAllServices operation.

4.2.3.2 GetLocalServiceElements

The GetLocalServiceElements operation allows an authorized Client to get the Service Elements and values (Description, Status, and CapabilitiesReady) of the specified Local Service with which a Cloud Imaging Service is communicating. The request can limit response to specific ElementGroups; allowed values for Requested Elements are CapabilitiesReady (if appropriate to the Imaging Service), Description, Status and DefaultJobTicket. The returned information corresponds to the information received from the Local Imaging System Proxy for that Local Service via the UpdateServiceElements operations.

4.2.4 Cloud Imaging System Management Operations

These Administrative Service operations are sent from a Client to a Cloud Imaging System Control Service and directly affect the Cloud Imaging System, Cloud Imaging Services and/or affect the Jobs of multiple Job Owners. Access is reserved for Administrators or

Operators. The Cloud Imaging System Operations are listed in Table 7 and are described in Section 7 of the System Object and System Control Service Semantics [PWG5108.05], with the addition of the GetLocalSystems and GetLocalSystemElements described in 4.2.4.1 and 4.2.4.2 below. These additional operations allow administrative view of the Local Imaging System(s) with which the Cloud Imaging System communicates via a Proxy, and the accessible Elements of these Local Imaging System(s).

Cloud Imaging System Management operations do not directly affect downstream Imaging Systems, the Local Imaging System Proxy(s) which connect to the Cloud Imaging Service, or the Devices with which these Local Imaging System Proxy(s) interface.

Note that, when directed to specific Imaging Services, some operations parallel the administrative operations described in paragraph 4.3.3.; when directed to the System Control Service without a specific Imaging Service identified, such operations apply to all supported Imaging Services in the Cloud Imaging System, other than the System Control Service itself.

Table 7 - Administrative Cloud Imaging System Service Operations

Operation	Request Parameters (Note 1)	Response Parameters (Note 3)	Notes
DeleteService	ServiceUuid, Id, ServiceType (of Service to be deleted)		2, 4, 11
DisableAllServices			4
EnableAllServices			4
GetLocalSystemElements	LocalSystemUuid; RequestedElements (Services, SystemConfiguration, SystemDescription, SystemStatus)	LocalSystemUuid; SystemElements (Services, SystemConfiguration, SystemDescription, SystemStatus), Unsupported Elements	
GetLocalSystems		List of (LocalSystemUuid; SystemName)	
GetSystemElements	ElementsNaturalLanguageRequested; RequestedElements (Services, SystemConfiguration, SystemDescription, SystemStatus)	SystemElements (Services, SystemConfiguration, SystemDescription, SystemStatus); Unsupported Elements	
ListAllServices	ElementsNaturalLanguageRequested	List of ServiceSummary (9)	12
PauseAllServices			4, 5
PauseAllServicesAfterCurrentJob			5,
RestartAllServices	IsAcceptingJobs; StartServicePaused		4, 8, 9, 10
RestartService	IsAcceptingJobs; Id ; StartServicePaused; ServiceUuid; ServiceType		6, 7, 8, 9, 10
ResumeAllServices			4, 5
SetSystemElements	OperationMode; SystemElements	UnsupportedElements	
ShutdownAllServices			4
ShutdownService	ServiceUuid; Id , ServiceType		11
StartupAllServices	IsAcceptingJobs; StartSystemPaused		4, 8, 9, 10
StartupService	IsAcceptingJobs; StartServicePaused; ServiceType	Id ; ServiceUuid	4, 8, 9, 10

Note 1: Elements in bold font are mandatory for the associated operation. All Client Management Requests can include the following Elements.

ElementsNaturalLanguage;

ServiceUuid (Cloud System Control Service);

Message

RequestingUserName and/or RequestingUserUri (mandatory). The RequestingUser for these operations is the Administrator

The RequestingUserName or RequestingUserUri can be used by the Cloud System Control Service to determine whether the requestor is authorized to make the request. Some implementations can require further authentication of the requestor's identity. If the requestor is not determined to have access, the Service rejects the request (unless security procedures dictate no response)

Note 2: The identification of the Service to be deleted, shutdown or restarted by the mandatory Elements, **Id** and **ServiceType** is consistent with the DeleteService operation defined in the System Object and System Control Service Semantics (PWG5108.06). However, particularly for Cloud Services, it is preferable to provide the ServiceUuid of the Service to be deleted.

Note 3: All Cloud Imaging Service Responses correlate to the Request and can include the following Elements.. Elements in bold font are mandatory for the associated operation.

ElementsNaturalLanguage (if response includes Element(s) in natural language)

OperationStatusCode (mandatory); indicates that operation have been accepted or not and possibly error condition (e.g., Request identifies a Service that is not recognized or there is some error in the received operation request format.)

Message; Cloud Service response text message identifying the error condition and reason

Note 4: This operation applies only to the Cloud Imaging Services, not the Cloud System Control Service.

Note 5: The operation applies only to Job based Services (e.g., FaxOutService, PrintService and ScanService),, not to the CloudSystemControlService

Note 6: When the object Service is the Cloud System Control Service the implementation restarts the SystemControlService and might restart the other Services as well.

Note 7: When the target Service is the Cloud System Control Service the implementation of the restart can be soft (i.e., affects software only) or hard (i.e., hardware and software reinitialized).

Note 8: When the Service startup is complete, the Service state is 'Idle' (See note 9). The Service will then follow the Service state model as defined in section 7.2.1 of [PWG5108.01].

Note 9: When the operation contains the "StartServicePaused" parameter and it is set to TRUE, the resulting Service state is 'Stopped' (i.e., transitions from 'Down' to 'Idle' then immediately to 'Stopped'). The Service will then follow the Service state model as defined in section 7.2.1 of [PWG5108.01].

Note 10: When the operation contains the "IsAcceptingJobs" parameter with a value of FALSE, the Service state is 'Idle' (See note 9). The Service will then follow the behaviors as defined in section 7.3.2.2 of [PWG5108.01]

Note 11: These operations result in an error when applied to the Cloud System Control Service.

Note 12: ServiceSummary for each service includes ServiceUuid, ServiceName, ServiceState, ServiceStateReasons for the service's endpoint and other general information.

4.2.4.1 GetLocalSystems

The GetLocalSystems operation allows an authorized User to get the LocalSystemUids and names of all Local Systems which are registered with the Cloud Imaging System. Local Systems are listed even if the System or the interfacing Local Imaging System Proxy is Offline or has registrations suspended, but not once the local System has been deregistered.

4.2.4.2 GetLocalSystemElements

The GetLocalSystemElements operation allows an authorized User to get the System Elements and values (Description, Status, Services) of the specified Local System. The request can limit response to specific Element groups; the allowed values for Requested Elements are Description, Status and Services. The returned information corresponds to the information received from the Local Imaging System Proxy for that Local System via the RegisterSystem and UpdateSystemElements operations.

4.3 Transaction Sequences

4.3.1 Registration Sequence

The message sequence in Figure 5a plots the specific interactions outlined in paragraph 4.1.2 for Local Imaging System registration and initialization of the communication with each of the Cloud Imaging Services. Figure 5b represents the continuing communications between the Proxy and Cloud Imaging Services by which the Local and corresponding Cloud Services are kept in step.

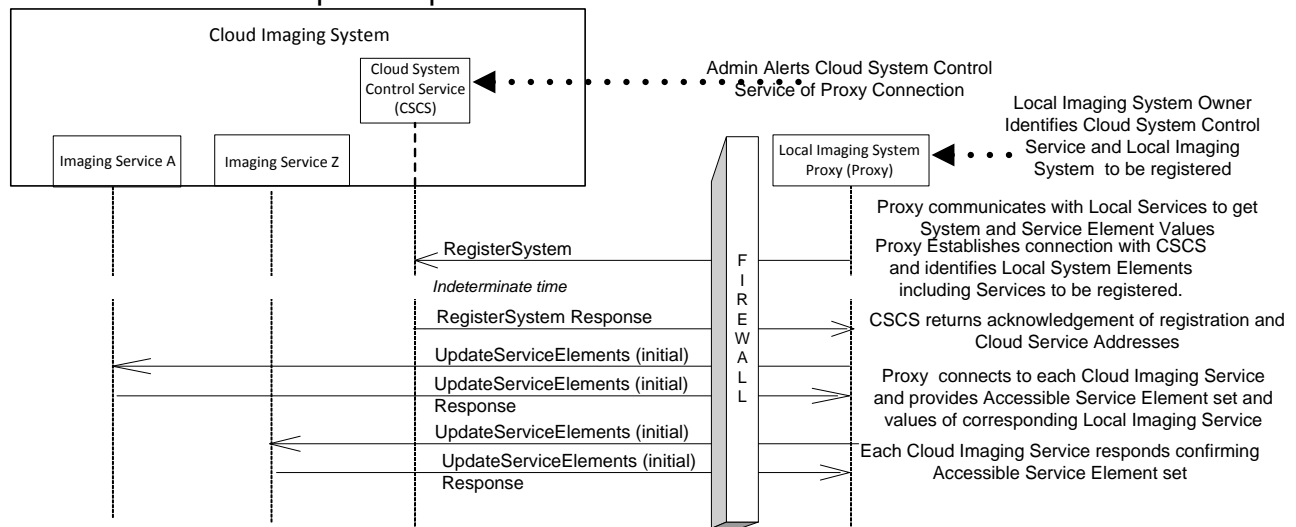
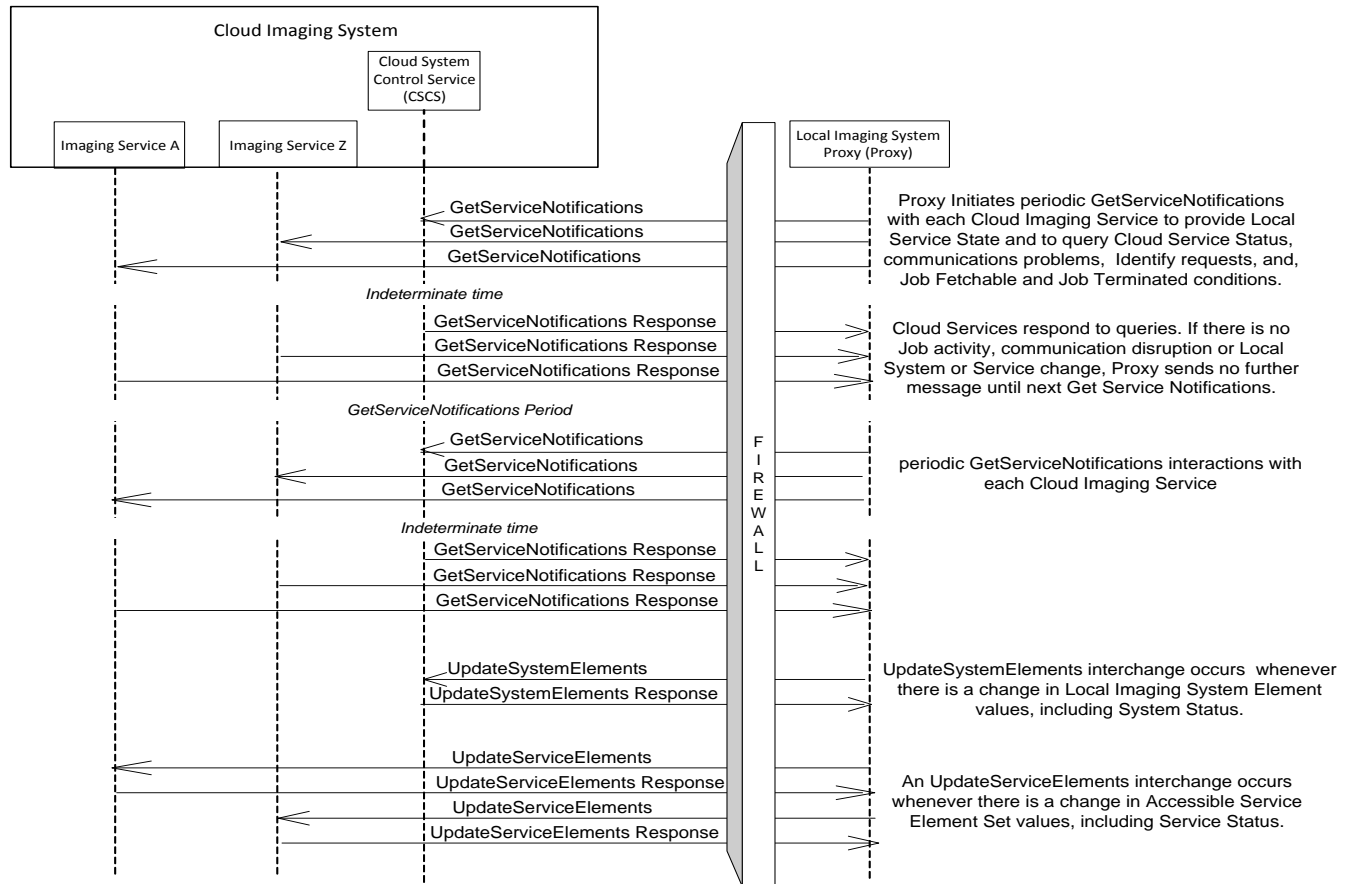


Figure 5a System Registration and Service Initialization



- Note: 1. All messages are initiated by the Local Imaging System Proxy.
 2. Every message has a response from the addressed Service.
 3. Proxy does not need to have a response from a previous message before sending a subsequent message.
 4. Services do not necessarily need to respond to messages in the order received.

Figure 6b Proxy Polling and Elements Updates

4.3.2 Status Realignment

Although there will be multiple connections and disconnections between a Local Imaging System Proxy and a Cloud Imaging Service, communication between Proxy and a Cloud Services is considered lost:

1. When the Proxy is unable to receive a response from a Cloud Service to which it is sending a message;
2. When the Cloud Service fails to receive any communication from the Local Imaging System Proxy over an 'Offline time-out' period and returns a time-out message when communication is reestablished; or
3. When the Proxy can have lost track of the Jobs and or the state of the Jobs it has fetched, as can occur when either the Proxy and/or the Local Imaging System is rebooted or has been powered down and restarted.

In any of these circumstances, Service and Job status information in the Cloud Services and the Local Services are to be realigned. The message sequence for resynchronization is in Figure 6 and consists of UpdateSystemElements, Update ServiceElements and UpdateActiveJobs messages sent by the Proxy to the corresponding Cloud Services. By the UpdateActiveJobs message, the Proxy informs the Cloud Service of the identification and states of Jobs that it considers fetched from the Cloud Service and still active. Usually System, Service and Job states are adjusted in the Cloud Services to agree with update information from the Proxy. Jobs which a Cloud Service understands to be active but which are not reported by the Proxy are again made 'fetchable. However, if Jobs have been canceled or aborted by the Client or some upstream Service, the Cloud Service can be unable to align status with the Proxy update information. In this case, the Cloud Imaging Service returns an error message in response to the UpdateActiveJobs message identifying Jobs that were listed in the UpdateActiveJobs message but are in a terminating state, and indicates their terminating state. The Proxy adjusts its state for such Jobs accordingly.

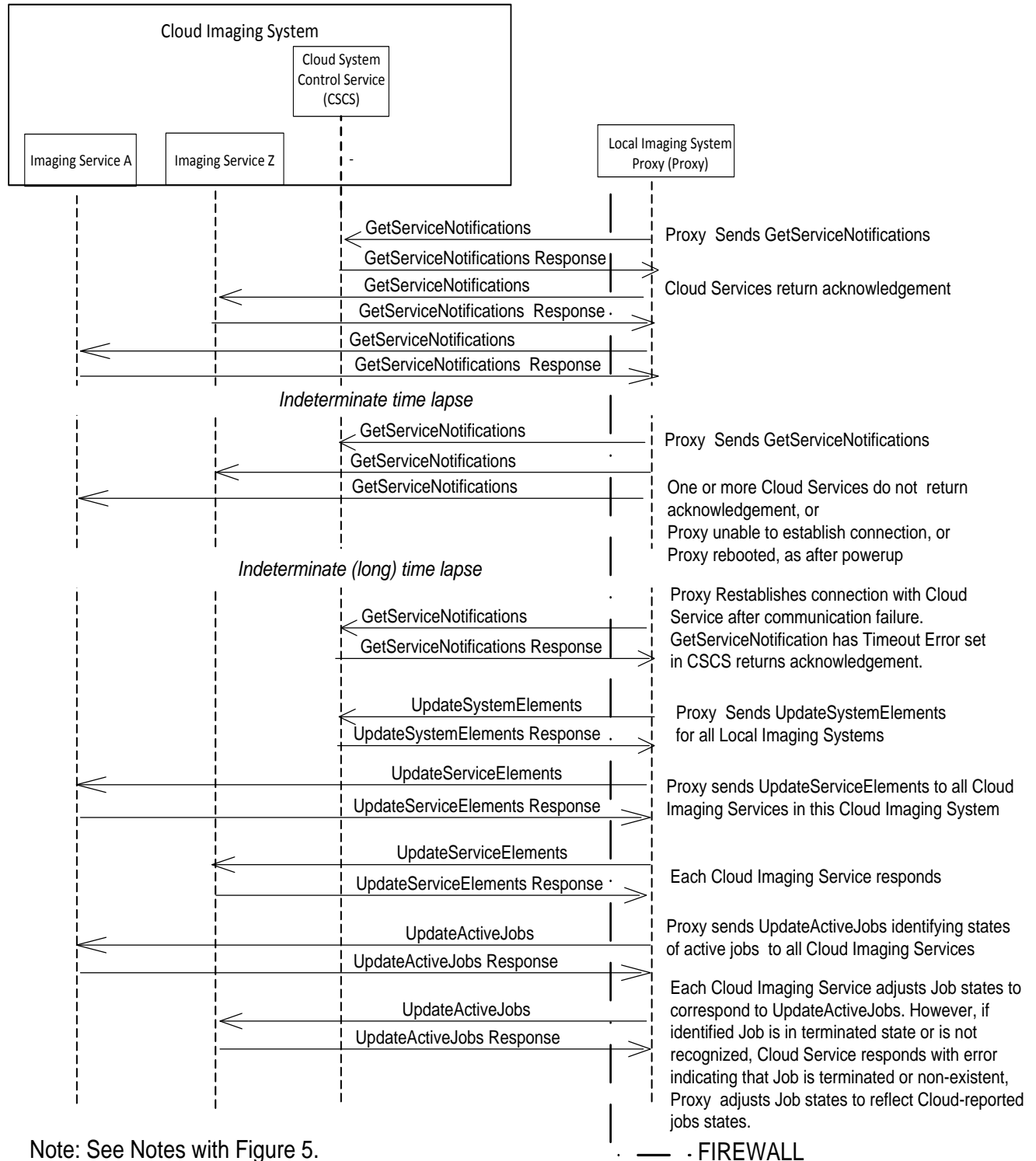


Figure 7 System, Service and Job Status Realignment

4.3.3 Cloud Print Service Sequence

The message sequence for Cloud Print is represented in Figure 7. The Client-Cloud Print Service interaction is the same as with any Client-Networked Print Service print Job request submission. In the general case of the Cloud Local Imaging System Proxy supporting several Local Imaging Services, the GetServiceNotifications messages will continue periodically during the Print Service interaction. If the GetFetchableJobs response indicated more than one Print Job available, the Cloud Local Imaging System Proxy can fetch more Jobs after (or during, depending upon the capability of the Local Print Service) the processing of the first Job. Note that the basic sequence is the same for FaxOut Services.

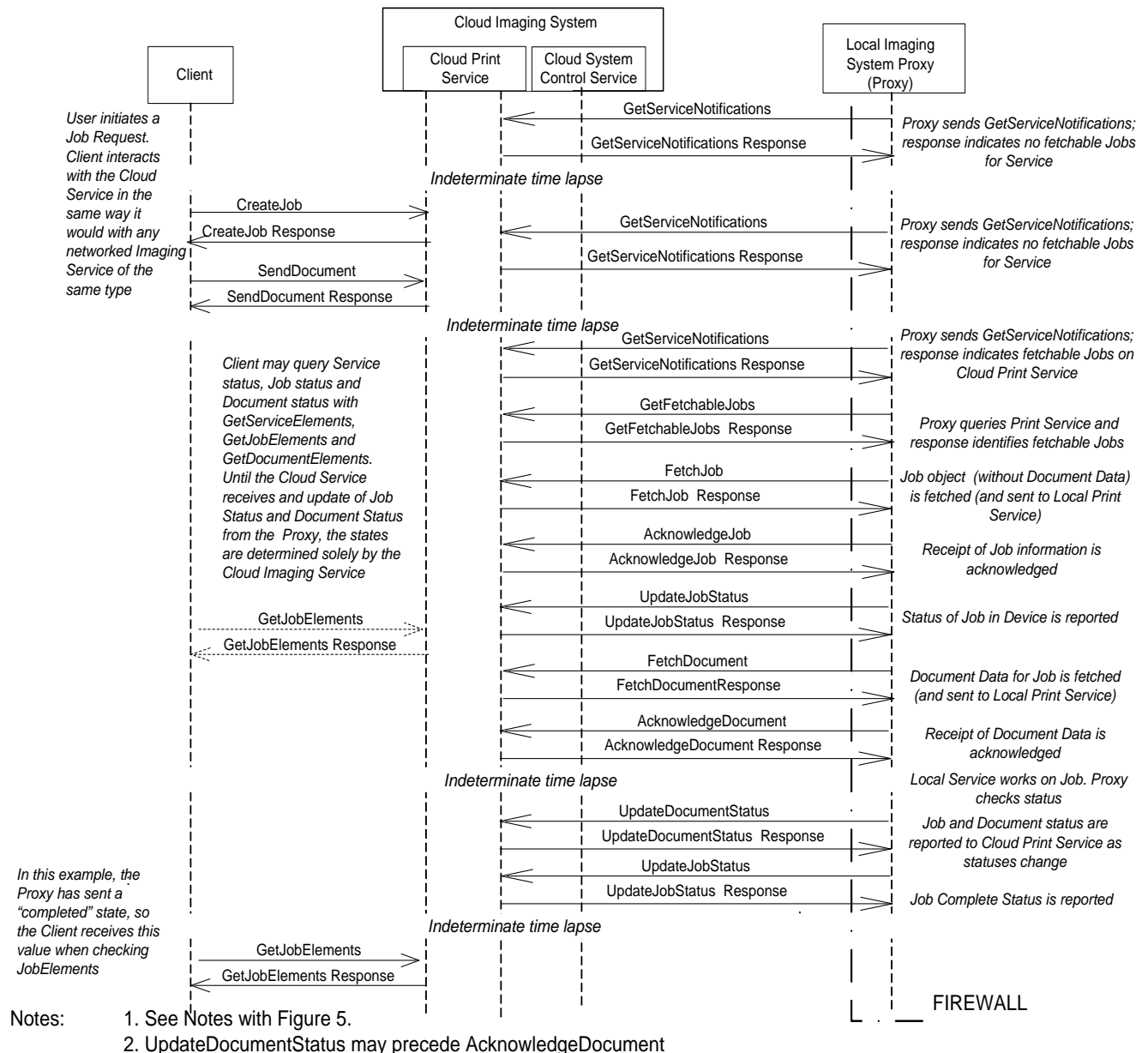


Figure 8 Simple Print Sequence

When DocumentData has been supplied by the Client, the Cloud Print Service response to the FetchDocument request includes the DocumentData for presentation to the Local Print Service (as indicated in Figure 7). The Proxy sends the AcknowledgeDocument message which indicates that the DocumentData is received and accepted, or reporting some problem with the data. If AcknowledgeDocument reports a problem, the Cloud Print Service response indicates whether the FetchDocument is to be resubmitted (if, for example, the Cloud Service will reformat the Document), the Document is to be skipped (allowing previous and/or following documents to be printed), or the Job is to be aborted.

Once the Document has been acknowledged, the Proxy sends UpdateDocumentStatus messages to indicate the status of the Document as the Document is being processed. As with the AcknowledgeDocument interchange, the Proxy can report problems and the Cloud Service can respond with desired actions.

When the Client submits a print-by-reference Job to the Cloud Print Service, the Cloud Print Service response to the FetchDocument request normally passes the reference on to the Proxy, provided that the Proxy has reported that the URI Scheme for the reference is supported and that the Document Data location is not recognized by the Cloud Service, perhaps as in an associated Cloud repository. If the Proxy and the Local Print Service cannot access the DocumentData, the Proxy AcknowledgeDocument message will indicate and identify the failure. The Cloud Print Service responds with the action that the Proxy is to take; the FetchDocument is resubmitted (if the Cloud Print Service can de-reference the DocumentData itself and respond with the de-referenced DocumentData), the Document is to be skipped, or the Job is to be aborted.

If the Proxy aborts a Job, either because it was instructed to or for some local reason, the Cloud Service has the option of trying to resolve the problem and making the Job again 'fetchable' or it might possibly redirect the Job to some other Local Print Service. If these alternatives do not work, the failed Job status is reported to the Client.

4.3.4 Cloud Scan Service Sequence

The message interchange sequence for a Scan Job starts in the same way as for a Print Job, except that the response to the FetchJob request contains InputElements, giving the hardcopy scan parameters and the Cloud Scan Service specified Document Destination.

The Cloud Scan Service will have been informed of the URI schemes supported by the Proxy/Local Scan Service. The Cloud Scan Service may have some associated storage destinations, perhaps provided for Pull Scan Jobs or as a Cloud repository. The Document Destination provided in response to the FetchJob request is the User defined destination, unless:

1. The Cloud Scan Service determines that the User-defined Document Destination is not supported by the Proxy/Local Scan Service;
2. The Cloud Scan Service recognizes the destination as an associated Cloud destination;
3. The User/Client has requested a Pull Scan mode.

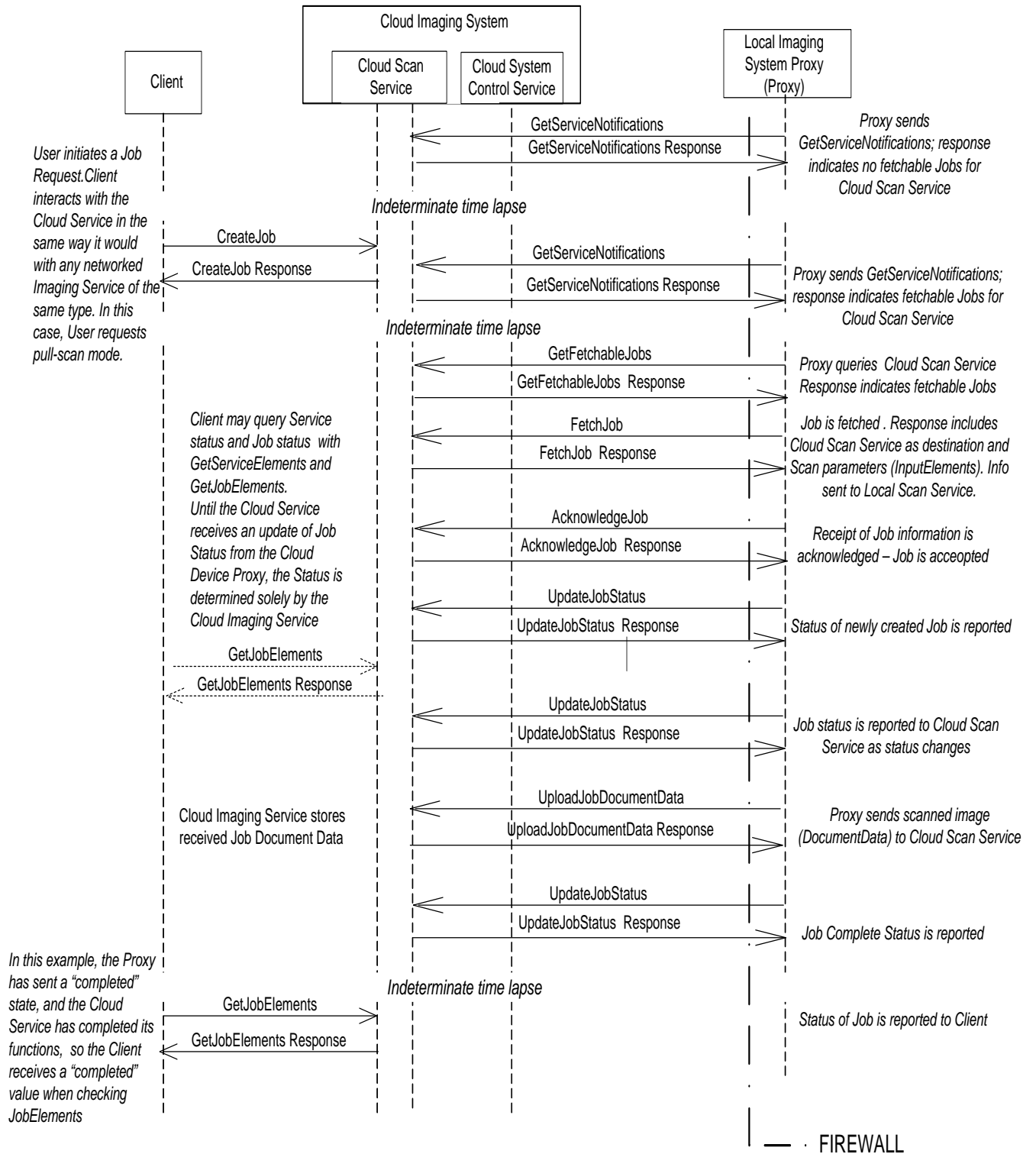
If any one of these conditions exist, the FetchJob response indicates that the Scan data is to be uploaded to the Cloud Scan Service.

On receiving this FetchJob response, the Proxy determines whether the specified InputElements are supported and whether it or the Local Scan Service can access the desired destination(s). If InputElements are supported and the DestinationUris can be accessed, the Proxy AcknowledgeJob message indicates that the Job is accepted. If InputElements are not supported and/or the DestinationUris cannot be accessed, the AcknowledgeJob message rejects the Job and identifies the problem. The Cloud Scan Service removes the Job from the Fetchable list, whether or not the Proxy AcknowledgeJob indicates the Job has been accepted or not.

If the Proxy/Local Scan Service cannot access the desired DestinationUris, the Cloud Scan Service determines whether it can access the desired DestinationUris. If it cannot or if InputElements are not supported, the Job is aborted and the Client is notified. If the Cloud Scan Service can access the desired location, it can reconfigure its Job handling approach and make the Job again fetchable.

If the Cloud Service intends to send the scan Document Data to the desired DestinationUris (or store it to be 'pulled' by the Client), the DestinationUris provided by the Cloud Scan Service in response to new FetchJob indicates that the Document Data is to be uploaded to the Cloud Scan Service.

The message sequence for Scan to a Cloud Scan Service accessible location is in Figure 8. In this example, the scanned image file destination specified by the User is accessible by the Cloud Scan Service but not the Local Scan Service. Therefore, the Local Imaging System Proxy uploads this file to the Cloud Scan Service, which stores the file before reporting the Job complete.



See Notes with Figure 5.

Figure 9 - Cloud Scan Sequence - Scan Document Data Sent to Cloud Service

4.3.5 Cloud FaxOut Service Sequence

The message interchange sequence for a FaxOut Job is identical to that for a Print Job, except that the response to the FetchJob request includes the facsimile destination (DestinationUris) and the response to the FetchDocument request can contain InputElements, giving the hardcopy scan parameters if the FaxOut Job is to include image data locally derived from hardcopy.

The FaxOut Service can support several different facsimile modes, including telephone line (PSTN) and Ethernet (SMTP). The Proxy/Local FaxOut Service capabilities will have been communicated to the Cloud Scan Service in terms of URI schemes supported. Unless the Cloud Scan Service sees the User-defined Document destination as unsupported, the User defined DestinationUris is communicated to the Proxy in the FetchJob response and the Proxy or the Local Scan Service is given the opportunity to transmit the facsimile.

On receiving this DestinationUris Element, the Proxy determines whether it or the Local FaxOut Service can transmit the facsimile. If the InputElements are supported and at least one DestinationUris URI scheme is supported, the Proxy AcknowledgeJob message indicates that the Job is accepted but any problems (such as inaccessible DestinationUris URI schemes) are identified. If InputElements are not supported, the AcknowledgeJob message rejects the Job and identifies the problem. The Cloud FaxOut Service removes the Job from the Fetchable list, whether or not the Proxy AcknowledgeJob indicates the Job has been accepted or not.

If the Cloud FaxOut Service determines that it can access URI schemes not supported by the Proxy/Local FaxOut Service, it can continue with the Job and indicate in the FetchDocument response that Document Data is to be uploaded to the Cloud FaxOut service in addition to the Proxy/LocalFaxOut Service transmitting the Document via any requested DestinationUris URI scheme that it supports.

A FaxOut Job can include both 'soft ' documents available as Document Data supplied through or referenced by the Cloud FaxOut Service and DocumentData derived from hardcopy by the Local FaxOut Service. After a FaxOut Job has been accepted in a AcknowledgeJob message, the Proxy will send a FetchDocument message. The response to this message can be the Document Data or a reference to the Document Data, just as in the response to a Print Service FetchDocument, and handling of access (de-referencing) problems is the same. However, since the FaxOut Job can also contain Digital Documents derived by scanning hardcopy at the Local FaxOut Service, the response to the FetchDocument message can be the InputElements for the scanning. As mentioned above, the FetchDocument response can also include a DocumentTicket which preempts information in the Job Ticket supplied in response to the FetchJob message.

Figure 9 shows the message sequence for a Facsimile to be derived from a Local FaxOut hardcopy scan and which uses the Cloud FaxOut Service for transmitting the facsimile to at least one of the desired destinations.

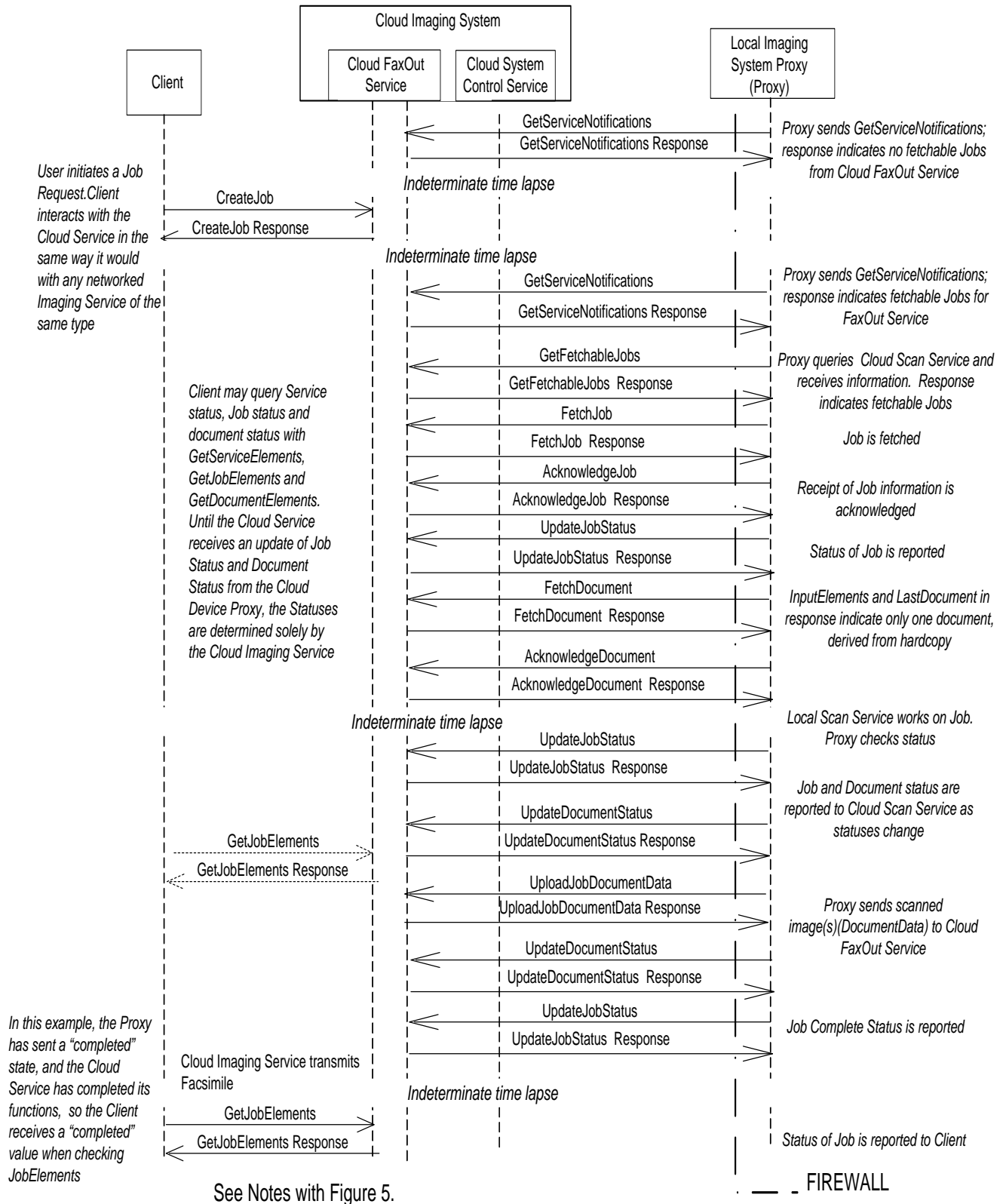


Figure 10 FaxOut Message Sequence with Cloud FaxOut Service Transmitting

4.3.6 Device Exception, and Job Abort or Cancel Sequences

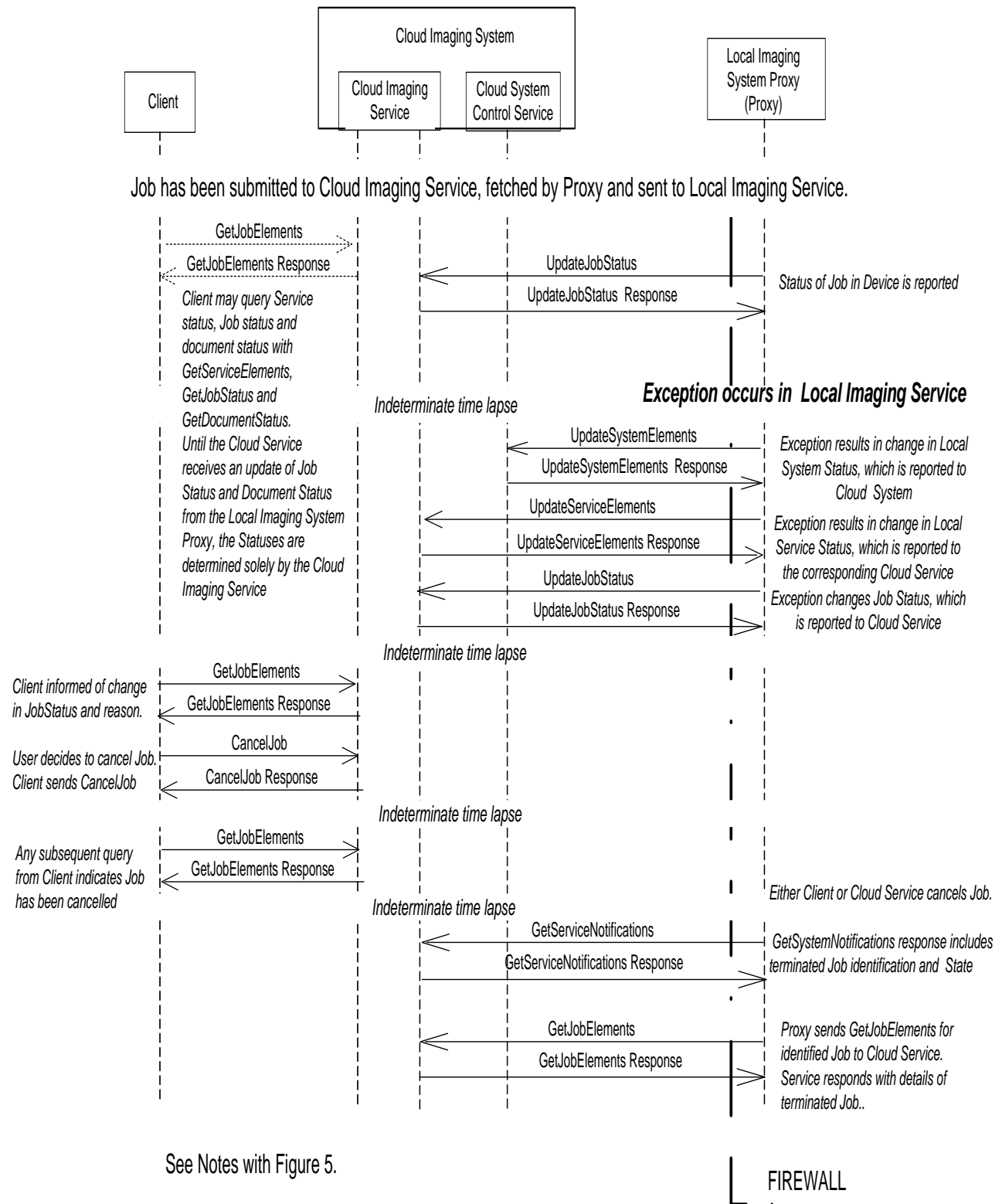
A Local Imaging Service subunit fault, such as a paper jam or a scanner bulb failure is reported to the applicable Cloud Imaging Service via an UpdateServiceElements message. Furthermore, if such an occurrence affects an Imaging Job submitted through the Cloud, additional Job-specific messages are exchanged among the components. These are represented in Figure 10.

A Job can be aborted by a Cloud Imaging Service or a Local Imaging Service, or it can be canceled by an Administrator of either a Cloud or Local Imaging Service. In the case of Abort or Cancel at Local Imaging Services or downstream Cloud Services, the Job State is communicated to Cloud Imaging Service interfacing directly with the Client in the same way that any Job state change is reported. The Client is then informed of altered Job State using the same mechanisms as in any Client-Networked Imaging Service interaction.

A Client, either at the User's request or for some other reason, can issue a CancelJob or CancelCurrentJob to the Cloud Imaging Service. If the Job to be canceled is active in a Local Imaging Service, the servicing Proxy is notified in the GetServiceNotifications response (or by another notification mechanism.) The Proxy can then send a GetJobElements message to verify the status of the terminated Job and determine the circumstances for termination (JobStateReasons) This information can be retained in a Proxy log. The message sequence is as shown in the lower part of Figure 9.

Although Figure 9 represents the communication of an upstream cancel after a Job is well into processing, a cancel or abort can occur at any time. Regardless of when the cancel or abort occurs, there are two methods by which the Cloud Service can provide information to the Proxy about the 'upstream' abort or cancel.

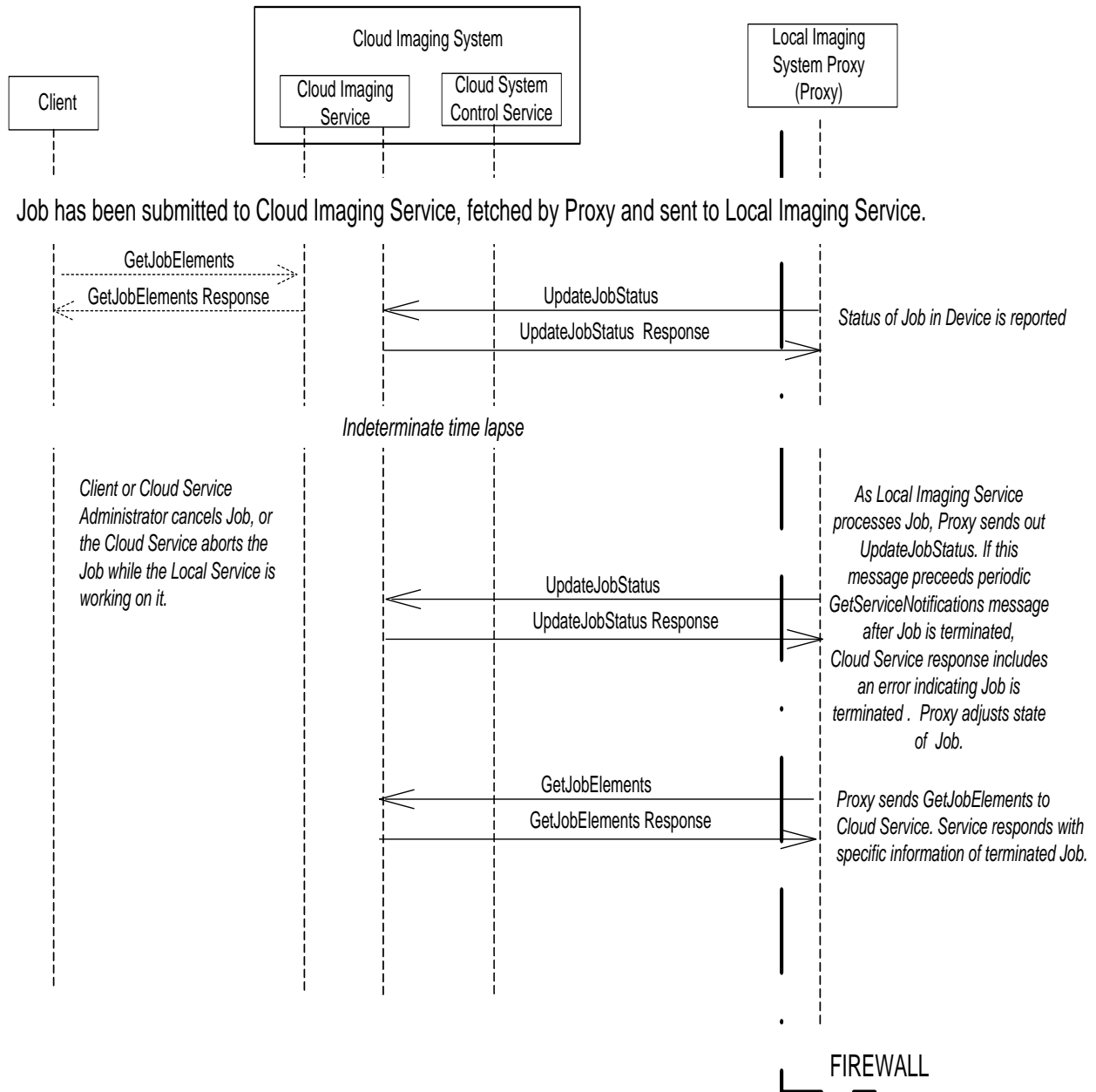
1. The JobTerminated information in the GetServiceNotifications response from the Cloud Service or in an asynchronous SystemNotification message from the Cloud Imaging Service.
2. An error response to any Proxy message by which the Cloud Service indicates an identified locally active Job as terminated, not fetchable, or not recognized.



See Notes with Figure 5.

Figure 11 - Device Exception with Resulting Job Cancel

A message sequence when a Proxy Job message is sent before the Proxy receives or implements JobTerminated information in a GetServiceNotifications response is shown in Figure 11. The Cloud Service response to the message includes an error indication that the identified Job is in a terminated state. The Proxy needs to adjust its state for the Job and will send a GetJobElements message to determine the details of the Job status.



See Notes with Figure 5.

Figure 12 - Sequence after Upstream Abort or Cancel when UpdateJobStatus precedes GetServiceNotifications.

5. Conformance Requirements

This specification defines a general model for the interaction of Clients, Cloud-based Imaging Systems and non-cloud but networked Imaging Systems to provide Users with Imaging Services using the accessibility and capability advantages of Cloud Services. This specification does not specify a particular implementation or binding, and it is expected that any binding of this model can depart in some specifics from the nomenclature and form used in this model description.

The conformance requirements for bindings of this model are:

1. Adherence to the general form of the Model including the two-part interface between:
 - a. Client-to-Cloud Imaging Service, with a typical Client-to-Networked Imaging Service interface
 - b. Local Imaging Service Proxy-to-Cloud Imaging Service interface, with the Proxy interface defined in this specification.
2. Adherence to the functions of the Local Imaging System Proxy interface operations defined in paragraph 4.2.2 of this specification, although the names and functional specifics of individual operations can vary.
3. Conformance to the standards referenced in Sections 6 and 7 of this specification.

6. Internationalization Considerations

For interoperability and basic support for multiple languages, conforming implementations MUST support:

1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
2. The Unicode Format for Network Interchange [RFC5198] which requires transmission of well-formed UTF-8 strings and recommends transmission of normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

Unicode NFC is defined as the result of performing Canonical Decomposition (into base characters and combining marks) followed by Canonical Composition (into canonical composed characters wherever Unicode has assigned them).

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

Unicode Bidirectional Algorithm [UAX9] – left - to - right, right - to - left, and vertical

Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

Unicode Normalization Forms [UAX15] – especially NFC f or [RFC 5198]

Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

Unicode Collation Algorithm [UTS10] – sorting

Unicode Locale Data Markup Language [UTS 35] – locale databases

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

Unicode Character Encoding Model [UTR17] – multi - layer character model

Unicode in XML and other Markup Languages [UTR20] – XML usage

Unicode Character Property Model [UTR23] – character properties

Unicode Conformance Model [UTR33] – Unicode conformance basis

7. Security Considerations

The interfaces defined in this specification require the same security considerations as defined in MFD Model and Common Semantics [PWG5108.01] In addition, as appropriate, Clients, Cloud Imaging Services and Local Cloud System Proxies MUST:

1. Utilize Transport protocol capabilities to protect against DNS rebinding attacks;
2. Provide confidentiality of data in transit;
3. Provide confidentiality of Document and Job data at rest; and
4. Authenticate Clients, Cloud Imaging Services and Proxies.

8. IANA and PWG Considerations

There are no requirements for IANA registration for this specification. However, the Proxy component and any new Operations and Elements defined in this specification will be reflected in the PWG Semantic Model. Table 8 in Section 12 of this specification (Semantic Model Elements Referenced in Cloud Model) specifically identifies the new Elements defined in this specification.

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10. Editor's Addresses

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11. Appendix A - Proxy to Local Print Service Interface Example (Informative)

This specification is concerned with the communication between a Cloud Imaging System and the Services of a Local Imaging System where the Cloud Imaging System cannot initiate communication with the Local Services because of a firewall or other security restriction. The solution requires the use of a Local Imaging System Proxy, essentially a Client that communicates Local Imaging System, Service, and Job information to the Cloud Imaging System and Services; and communicates Cloud Imaging System, Service, and Job information to the Local Imaging System and Services. A set of Proxy Operation requests and Cloud responses are defined, but recognizing that the Proxy may take many forms, the interface between the Proxy and the Local Systems and Services is not defined. The Proxy may be an integral part of the device housing the Local System; an intelligent independent application interfacing with many Local Imaging Systems and capable of preprocessing, data storage, and remote file access; or anything in between these two extremes.

However, the Proxy operations have generally been structured to mirror standard Client to Imaging Service operations and to use the same Semantic Model Elements so that the Proxy use standard Client to Service operations as defined in the PWG Semantic Model. The Proxy-Cloud interactions in a simple Print Job submitted to a Cloud Print Service are represented in Figure 12, along with possible corresponding Proxy to Local Print Service interactions.

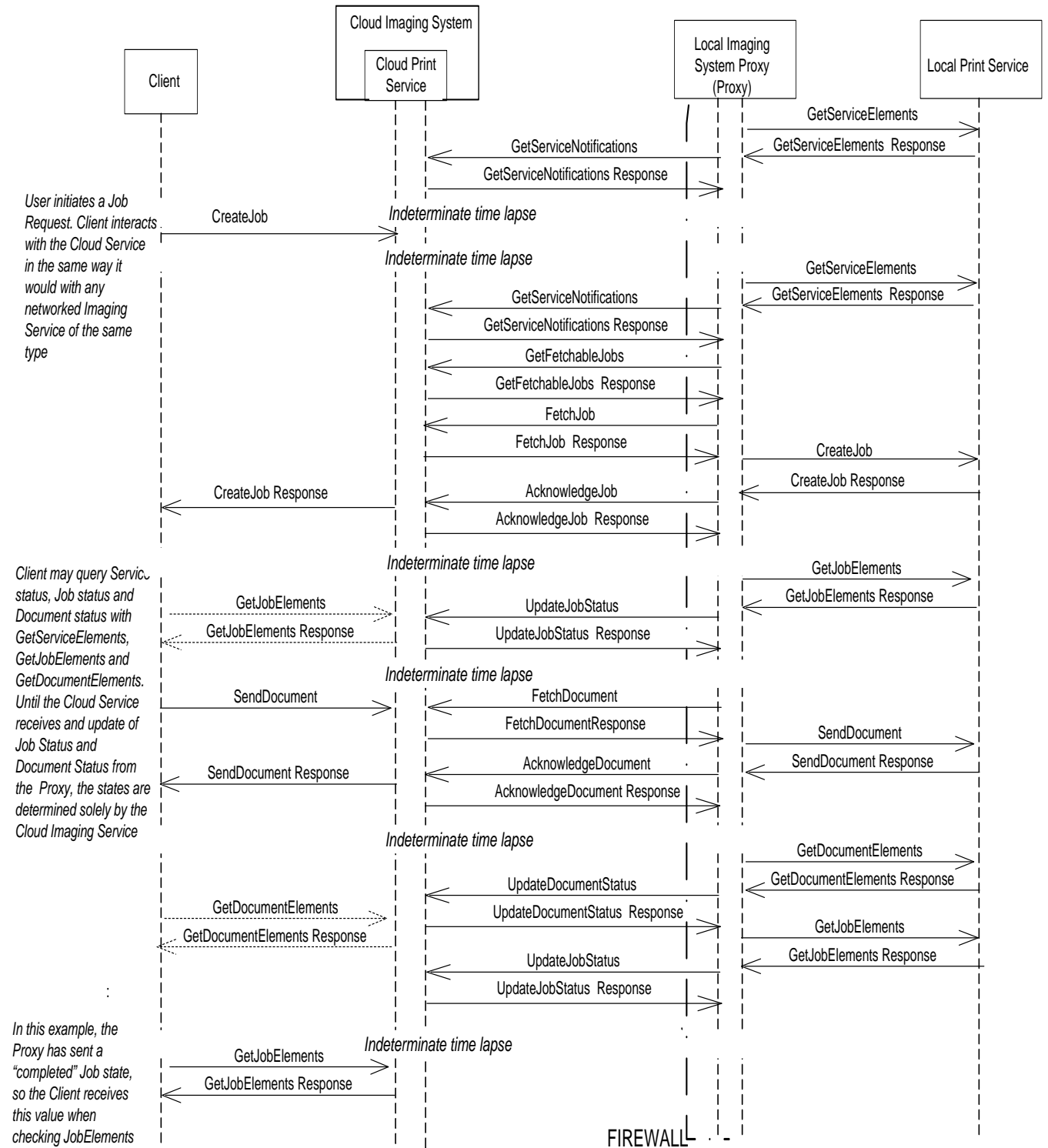


Figure 13 - Example of Client-Cloud Print Service-Proxy-Local Print Service Interaction for Simple Print Job Submitted to the Cloud Print Service

12. Appendix B- Reference of Elements (Informative)

The Operations referenced in this specification refer to Elements on the PWG V2 Semantic Model, with a few new Elements added. It is anticipated that these new Elements will be included in PWG V3 Semantic Model. Table 8 lists the Elements referenced directly or indirectly in the Cloud Imaging Model operations, along with simple definitions as are given in the PWG MFD Model and Common Semantics [PWG5108.01] and System Object and System Control Service Semantics [PWG5108.06]. Newly added Elements are identified by being in bold font.

Table 8 - Semantic Model Elements Referenced in Cloud Model

Element Name	Data Type	Description	Reference
ActiveJobs	complex	A Service instance-specific queue containing all the Jobs that are waiting to be processed or are currently processing	[PWG5801] table 1
CharsetConfigured	keyword	The character set to which a Service or System is configured. <i>CharsetWKV</i>	[RFC2911] Para 4.3.19
Compression	keyword	compression algorithm used on the Document Data, if any. <i>CompressionWKV</i>	[RFC2911] para 4.4.32
CompressionAccepted	list of keywords	set of supported compression algorithms for Document content, ordered higher preference first	[RFC2911] Para 4.4.32
CompressionSupplied	keyword	compression algorithm used for the Documents Data <i>CompressionWKV KeywordNsExtensionPattern</i>	PWG5100.7 para 5.2.1
ConfiguredServices	list of ServiceSummary	The list of Services that have been administratively configured to run on this system instance. (Contains <i>ServiceSummary</i>)	[PWG5108.06], table 3
Copies	int	number of copies to be printed	[RFC2911] para 4.2.5
DefaultJobTicket	complex	<i>DocumentProcessing</i> <i>JobDescription</i> <i>JobProcessing</i>	[PWG5801]
DestinationAccesses	complex	authentication information for a referenced Document	4.2.2.5
DestinationUri	uri	URL used to transfer a Digital Document to its Destination.	PWG5801] Para 5.2.3.1
DetailedStatusMessages	list of strings	additional detailed and technical information about the Job. Element	[RFC2911] para 4.3.10
DeviceID	string	IEEE 1284 Device ID	[PWG 5105.1] Para 11.1
Document	complex	Composed of <i>DocumentReceipt</i> , <i>DocumentStatus</i> and <i>DocumentTicket</i>	[PWG5801] Para 6
DocumentData	complex	Digital data to be printed or derived from scanned image	[PWG5801]
DocumentDataGetInterval	int	number of seconds that the scan Client should wait before trying the "GetNextDocumentData" operation again. .Derived from <i>document-data-get-interval</i> in [PWG5100.17] para 8.1.4	4.2.1.3
DocumentDataWait	boolean	TRUE value indicates that Scan Client wants to wait for additional DocumentData. .Derived from <i>document-data-get-interval</i> in [PWG5100.17] para 8.1.5	4.2.1.3
DocumentDescription	complex	<i>DocumentDigitalSignature</i> <i>DocumentMessage</i> <i>DocumentName</i>	[PWG5801]

Element Name	Data Type	Description	Reference
		DocumentNaturalLanguage LastDocument CompressionSupplied DocumentCharsetSupplied DocumentDigitalSignatureSupplied DocumentFormatDetailsSupplied DocumentFormatSupplied DocumentFormatVersionSupplied DocumentMessageSupplied DocumentNameSupplied	
DocumentElements	complex	DocumentNumber ElementsNaturalLanguageRequested JobId RequestedElements RequestingUserName RequestingUserUri	[PWG5801]
DocumentFormat	list of keywords	Digital Document formats supported by the Service. values are MIME types. DocumentFormatWKV	[PWG5801]
DocumentFormatAccepted*	list of keywords	Digital Document formats supported by the Service. values are MIME types, in priority order DocumentFormatWKV	[RFC2911] Para 3.2.1.1, 4.4.21 [PWG5100.5] Para 9.1.12
DocumentMessage	string	message from either 1) the User to the Operator about the Document or 2) from the Operator system Administrator or "intelligent" process to indicate to the End User the reasons for modification or other management action taken on the Document.	[PWG5100.5] para 9.1.20
DocumentName	string	name for this Document to be used in an implementation specific manner.	[RFC2911] para 3.2.1.1
DocumentNumber	int	uniquely identifies a Document within a Job.	[PWG5100.4] [PWG5100.5]
DocumentPassword	string	the unencrypted passphrase to be used to access the document content	[PWG5100.13] para 5.1.2
DocumentReceipt	complex	Values of Elements in DocumentTicket used by the Service for processing the Document	PWG5801] Para 6.3
Documents	complex	List of Documents	PWG5801] Para 6
DocumentState	keyword	current state of Document. DocumentStateWKV	[PWG5100.5] para 9.1.25
DocumentStateReasons	list of keywords	additional detail about the Document state. The specific keywords allowed are defined within the specification for the Service. <i>DocumentStateReasonsWKV</i> , <i>KeywordNsExtensionPattern</i>	[PWG5100.5] para 9.1.27 and {RFC2911] para 4.3.8
DocumentStatus	complex	See [PWG5108.01] tables 70, 71.	[PWG5108.01] para 6.1
DocumentSummaries	complex	DocumentNumber DocumentState DocumentStateReasons ImpressionsCompleted ImagesCompleted	[PWG5801]
DocumentTicket	complex	DocumentDescription DocumentProcessing	[PWG5801]
DocumentUri	anyUri	An urn::uuid unique URI value identifying the Document	[RFC4122]
DocumentUuid	anyUri	An urn::uuid unique URI value	[RFC4122]
ElementsNaturalLanguage	list of keywords	supported natural languages for the Elements with a string syntax (See [RFC3066] NaturalLanguageWKV	[PWG5801]

Element Name	Data Type	Description	Reference
ElementsNaturalLanguageRequested	keyword	natural languages for the Elements with a string syntax (See [RFC3066] NaturalLanguageWKV	[PWG5801]
FetchStatusCode	int	Operation Element: indicates status of identified Job or Document fetch	4.2.2.2
FirstIndex	int	specifies the first object or Element, starting at 1, to be returned in a response	PwgSmRev1-185 PWG 5100.13 para 5.1.3
Id	complex	Identification of Service	PwgSmRev1-185
IdentifyActions	int	Operation Element: indicates type of identify action desired	4.2.1.2
IdentifyDeviceState	int	Operation Element: Indicates state of previous IdentifyDevice request	4.2.2.10.1
ImagesCompleted	int	Progress measure in terms of output images. May be for Job or as subunit counter	[PWG5106.1] para. 5.2.1
ImpressionsCompleted	int	Progress measure in terms of output impressions May be for Job or as subunit counter	[RFC2911] para. 4.3.18.2
InputElements	complex	specifies the scanning source and other Elements for hardcopy documents in an AddDocumentImages operation (from input-attributes)	[PWG5100-15]
IsAcceptingJobs	boolean	If True, Service is currently able to accept CreateJob operation. Method of configuring the value for this Element is implementation-specific e.g. local console web page.	[PWG5801]
Job	complex	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.	[PWG5801] para 5
JobDescription	complex	See [PWG5108.01] tables 47, 48, 49 entries are single-valued	[PWG5108.01] para 4.3.3
JobElements	complex	JobReceipt JobStatusJobTicket	[PWG5801] para 5
JobFetchable	boolean	Operation Element: If TRUE, Cloud Imaging Service has one or more fetchable Jobs	4.2.2.10
JobHistory	complex	A Service instance specific queue containing all the Jobs that have reached a terminating state. The terminating states are defined as Completed, Aborted and Canceled.	[PWG5801] para 4.1
JobHoldUntil	keyword	duration of time that a Job is put on hold. HoldUntilWKV	[RFC2911] para 4.2.2
JobHoldUntilTime	dateTime	absolute date and time a Jos Element allows you to hold a remotely submitted Job until a specific time for processing.	[PWG5100.11] para 5.4
JobId	int	JobId of the Job to which this Document belongs.	[PWG5100.5] para 9.1.18
JobIds	Listof JobId	List of JobIds	[PWG5100.5] para 9.1.18
JobName	string	Service sets this to the Client-supplied end-User friendly name for the Job. When it is not supplied by the Client the Service generates a name from other information.	[RFC2911] para 4.3.5
JobOriginatingUserName	string	Service sets this to the most authenticated printable name that it can obtain (example: "John Doe" \authDomain\John Doe")	[RFC2911] para. 4.3.6
JobOriginatingUserUri	anyUri	URI of the User originating the Job	[PWG5801]
JobPassword	octetString	password supplied by the Client encrypted according to method specified by the Client in the JobPasswordEncryption Element.	[PWG5100.11] para 6.1
JobPasswordEncryption	keyword	encryption the Client is using for the supplied value	PWG5100.11] para

Element Name	Data Type	Description	Reference
		of the JobPassword Element. JobPasswordEncryptionWKV KeywordNsExtensionPattern	6.2
JobReceipt	complex	Contains the Elements DocumentProcessing JobDescription JobProcessing with Elements' values used by Service	[PWG5801]
JobState	keyword	current state of Job. The state values cannot be extended by an implementation. From RFC2911 JobStateWKV	[RFC2911], para. 4.3.7
JobStateMessages	string	information about the Job State and StateReasons in human readable text. If the Service supports this Element it is able to generate the messages in any of the natural languages supported by the Service.	[RFC2911], para. 4.3.6
JobStateReasons	list of keywords	additional detail about the Job state. The typical keyword values are listed below. Values specific to a service are identified in the specification for that service. JobStateReason	para. 4.3.8 of [RFC2911] and para. 4.5.1.3 of [WS-Scan].
JobStatus	complex	See [PWG5801] tables 58, 59, 60	[PWG5801] para 5.1
JobSummaries	complex	list of JobSummary Elements	[PWG5801]
JobSummary	complex	Set of complex Elements JobId JobName JobOriginatingUserName JobState JobStateReasons	[PWG5801]
JobTable	complex	Composed of ActiveJobs and JobHistory Elements	PWG5801] para 4.1
JobTerminated	complex	Table of JobUUID, JobState for terminated Jobs	new
JobTicket	complex	DocumentProcessing JobDescription JobProcessing	[PWG5801]
JobUuid	anyUri	An urn::uuid unique URI value [RFC4122]	[RFC4122]
KOctets	int	total size of this Job's Digital Document(s) in integral units of 1024 octets.	[RFC2911] para 4.3.17.1
LastDocument	Boolean	last Document in the Job. (Element set to FALSE or omitted for Document which is not the last)	[RFC2911] para 3.3.1
Limit	int	Argument in operation request setting a limit to the maximum number of instances to be provided in the response.	RFC2911
LocalServiceUuid	anyUri	The ServiceUuid of a Local Service when communicated by a Local Imaging System Proxy to a Cloud Service.	
LocalServiceUuid	anyUri	ServiceUuid of proxied Local service	table 3
MakeAndModel	string	Device manufacturer and model	[RFC2911] Para 4.4.9
Message	text	User readable message provided in operation request or response	
NaturalLanguageConfigured	keyword	NaturalLanguageWKV	[RFC2911] Para 4.4.19
OperationMode	keyword	Values are "add, modify, delete" indicating the nature of a Set operation ; OperationModeWKV	[PWG5108.06]
OperationStatusCode	int	Code in response to an operation request indicating state of operation	table 2
OwnerUri	anyUri	URI, that is an authoritative identifier (e.g. a 'mailto:' URI) of the authenticated Owner of this Service instance.	[RFC3986]
PredecessorJobId	int	JobId of Job of immediately higher priority than Job identified	[PWG5801] Table 79

Element Name	Data Type	Description	Reference
PreferredElements	complex	List of Elements and values returned by Service as preferred in response to any Validate request	PwgSmRev1-185
RegistrationSuspended	boolean	Operation Element: flag indication that proxied system is to be re-registered	4.2.2.10
RequestedElements	List of Element names	Operation Element - Names of Elements requested in a GET operation. What can be requested depends upon the operation	[PWG5801]
RequestingUserName	string	Operation Element - name of User derived from requesting-user-name in [RFC2911]	[PWG5801] [RFC2911]
RequestingUserUri	anyUri	An urn::uuid unique URI value identifying the requesting User	[PWG5801]
ResourceDirectoryUri:	anyUri	Address of the directory provided by the Cloud System Control Service for Local Imaging System Proxy storage of Resource material	4.1.1.1
ResourceKOctetsFree	int	Number of KOctets available in Resource directory for identified Local Imaging Service	4.1.1.1
ResourceKOctetsRequested	int	Number of KOctets requested in Resource directory by Local Imaging System Proxy for identified Local Imaging System	4.1.1.1
ResourceKOctetsSupported	int	Total Number of KOctets provided in Resource directory for identified Local Imaging System.	4.1.1.1
ServiceCapabilities	complex	DocumentTicketCapabilities, JobTicketCapabilities	[PWG5801]
ServiceCapabilitiesReady	complex	DocumentTicketCapabilities, JobTicketCapabilities	[PWG5801]
ServiceDescription	complex	See [PWG5801] table 52, 53	[PWG5801] para 4.6
ServiceElements	complex	ServiceCapabilities; ServiceConfiguration; ServiceDescription; ServiceStatus DefaultJobTicket	[PWG5801]
ServiceGeoLocation	anyURI	Geographic location code of service	[RFC5870]
ServiceLocation	string	User friendly indication of Service location (e.g., travel office)	[RFC2911] Para 4.4.5
ServiceName	string	User friendly identification of Service (e.g., Accounting Copier)	[RFC2911] Para 4.4.4
Services	complex	Referring to the Services in an Imaging System, including Copy, FaxOut, Scan, Resource, SystemControl	[PWG5108.01]
ServiceState	keyword	current state of service. The state is a unification of the service states from IPP and the Host Resource MIB (ObjectStateWKV)	[RFC2911] and [RFC2790].
ServiceStatus	complex	See [PWG5108.01] table 55 and 56.	[PWG5108.01] 4.7
ServiceType	keyword	Type of service in Imaging System (e.g. Scan, Print, Copy)	PWG5108.06]
ServiceUuid	anyUri	An urn::uuid unique URI value identifying a Service. For Cloud model Proxy-originated operation, ServiceUuid normally refers to a Cloud Service while LocalServiceUuid refers to a Local Service.	[RFC4122]
ServiceXriSupported	complex	XriUr,i XriAuthentication XriSecurity	[PWG5108.01]
StartServicePaused	boolean	Operation Element:	[PWG5108.06]
State	keyword	Current state of subject (System Service Job or Document) Appropriate keywords depend on subject	[PWG5801]
StateMessages	List of strings	information about the State and StateReasons in human readable text. If the Service supports this Element it is able to generate the messages in any of the natural languages supported by the Service.	[PWG5801]
StateReasons	List of keywords	additional detail about the state. The keywords are extensible. The standard keyword values are defined in paragraph 4.4.12 of [RFC2911] and paragraph 4.4.3.1 of [WS-Scan].	[PWG5801]

Element Name	Data Type	Description	Reference
		(StateReasonsWKVs)	
SystemConfiguration	complex	Consoles Covers FaxModems Finishers InputChannels InputTrays Interfaces Interpreters Markers MediaPaths Output Channels OutputTrays Processors ScanMediaPaths Scanners Storages Vendor Subunits	[PWG5801]
SystemDescription	complex	CharsetConfigured CharsetSupported DeviceId MakeAndModel MessageFromOperator NaturalLanguageConfigured NaturalLanguageSupported OwnerUri OwnerVCard PowerCalendar PowerEvent PowerTimeout SystemGeoLocation SystemInfo SystemLocation ServicesSupported SystemName	[PWG5801]
SystemElements	complex	Services SystemConfiguration SystemDescription SystemStatus	[PWG5801]
SystemGeoLocation	anyURI	Geographic location code of system	[RFC5870]
SystemLocation	string	User friendly indication of system location (e.g., travel office)	[RFC2911] Para 4.4.5
SystemName	string	User friendly identification of system (e.g., Accounting MFD)	[RFC2911] Para 4.4.4
SystemStatus	complex	<u>AccessModes</u> <u>ConditionTable</u> <u>ConfiguredResources</u> <u>ConfiguredServices</u> <u>CreateDate</u> <u>CurrentTime</u> <u>MessageDateTime</u> <u>MessageTime</u> <u>NaturalLanguage</u> <u>PowerCounters</u> <u>PowerGeneral</u> <u>PowerLog</u> <u>PowerMeters</u> <u>PowerMonitor</u> <u>PowerSupport</u> <u>PowerTransition</u> <u>SerialNumber</u> <u>SystemUuid</u> <u>State</u> <u>StateMessages</u> <u>StateReasons</u> <u>SystemHealth</u> <u>SystemConfigChangeNumber</u> <u>SystemTotals</u> <u>UpTime</u>	[PWG5801]
SystemUuid	anyUri	A urn::uuid unique URI value [RFC4122] - This is of the System being identified, Local or Cloud	[RFC4122]
TimeoutError	boolean	Operation Element: if TRUE Cloud Service requests the Proxy to do full update operations for the Local Imaging Service and an UpdateActiveJobs for that Local Service.	4.2.2.10.2
UnsupportedElements	complex	Operation Element: List of Elements in response that were requested in request that are not supported	[PWG5801]

Notes:

1. Elements in bold font did not appear in Semantic Model V2 and are defined in this specification.
2. Throughout this specification, the Element name "Document" has been used in place of the Semantic Model 2. Element name ImagingDocument. The Elements are the same.