



The Printer Working Group

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Cloud Imaging Requirements and Model

Status: Initial Draft

Abstract: This document contains specifications to support Cloud based Imaging using the PWG semantic model.

This document is a PWG Working Draft. For a definition of a "PWG Working Draft", see: <ftp://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf>

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<ftp://ftp.pwg.org/pub/pwg/cloud/white-cloudimagingmodel10-20130206.pdf>

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80 procedures and conventions. Printer manufacturers and vendors of printer related
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84 technically competent, has multiple, independent and interoperable implementations
85 with substantial operational experience, and enjoys significant public support.

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94

95 About the Cloud Imaging Work Group

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

101 For additional information regarding Cloud Imaging visit:

102 <http://www.pwg.org/Cloud/>

103 Implementers of this specification are encouraged to join the Cloud Imaging mailing
104 list in order to participate in any discussions of the specification. Suggested
105 additions, changes, or clarification to this specification, should be sent to the Cloud
106 Mailing list for consideration.
107

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145 1. Introduction

146 This specification introduces a set of requirements and model for Cloud Imaging
147 from a variety of clients and operating systems with secure traversal of firewalls to
148 any compliant system or output device. Legacy solutions are based on the sender
149 and printer residing on the same network or being directly connected. However, in
150 Cloud computing, clients and imaging devices are frequently on different networks
151 and legacy solutions are no longer functional.

152 2. Terminology

153 2.1 Conformance Terminology

154 Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED,
155 SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to
156 conformance as defined in IETF Key words for use in RFCs to Indicate Requirement
157 Levels [RFC 2119] The term CONDITIONALLY REQUIRED is additionally defined
158 for a conformance requirement that applies to a particular capability or feature.

159 2.2 Imaging and Cloud Terminology

160 Cloud Imaging, as defined in this specification, is consistent with the model implicit in
161 PWG MFD Model and Common Semantics v1.0 [PWG 5108.01], except that Cloud
162 Imaging places a set of Cloud-based components between the Client and the
163 Imaging Device. Normative definitions and semantics of printing terms used in this
164 specification are derived from [PWG 5108.01], with most of the terms in the more
165 general model being implicitly prefaced by “Cloud”. These Cloud Imaging specific
166 components and processes are described in detail or by reference in Section 4 of
167 this specification. The definitions of Cloud Imaging specific terms below are
168 summary statements provided for reference convenience and are in no way supplant
169 the detailed definitions provided in Section 4.

170 **Association:** the process by which a User is paired with a registered Device or
171 Cloud Service.

172 **Client-side** and **Device-side:** Cloud Imaging is distinguished by inserting a set of
173 elements in the Cloud environment between the Job Originator and the Imaging
174 Device. The path between the Job Originator and the Cloud is referred to as the
175 “Client-side”. The path between the Cloud and the Imaging Device is referred to as
176 the “Device-side”. The distinction is made because, in many cases, details of Client-
177 side interaction can be considered independently from Device-side interactions.

178 **Cloud Faxing:** from the Job Originators' viewpoint, an arrangement that uses Cloud-
179 based components to allow a User to locate a Fax Service appropriate to the User's
180 needs and access rights, to submit a Fax Job Request intended for eventual
181 processing by that Fax Service, and to query that status of the request and the
182 resulting Fax Job. However, this PWG Cloud Imaging model is structured to allow a
183 User with the proper credentials and subject to other restrictions of the Cloud
184 environment, to submit any Fax Service request defined in the PWG Semantic
185 Model [REF] to the Cloud Fax Service.

186 **Cloud Fax Client (Client):** the software component that implements the interface
187 between the User and the cloud-based Cloud Fax components, including
188 association with the cloud-based environment, for all Semantic Model Fax Service
189 elements and operations.

190 **Cloud Fax Manager:** the software component that implements the interface
191 between the Fax Service Device (Fax) and a cloud-based environment for
192 registration of the Fax; and that implements the interface between the Fax and one
193 or more cloud-based components, called Cloud Fax Services, for all Semantic Model
194 Fax Service [PWG5108.01] elements and operations and other extensions for Cloud
195 Faxing.

196 **Cloud Fax Service:** a cloud-based software component that implements the Service
197 supporting Client submission of Semantic Model Print Service requests. A Cloud Fax
198 Service communicates with one and only one Cloud Fax Manager and is created
199 when the Device is registered with the cloud-based environment. The Cloud Fax
200 Service acts as a cloud-based intermediary between the Client and Cloud Fax
201 Manager.

202 **Cloud Printing:** from the Job Originators' viewpoint, an arrangement that uses
203 Cloud-based components to allow a User to locate a Print Service appropriate to the
204 User's needs and access rights, to submit a Print Job Request intended for eventual
205 processing by that Print Service, and to query that status of the request and the
206 resulting Print Job. However, this PWG Cloud Printing model is structured to allow a
207 User with the proper credentials and subject to other restrictions of the Cloud
208 environment, to submit any Print Service request defined in the PWG Semantic
209 Model [REF] to the Cloud Print Service.

210 **Cloud Print Client (Client):** the software component that implements the interface
211 between the User and the cloud-based Cloud Print components, including
212 association with the cloud-based environment, for all Semantic Model Print Service
213 elements and operations.

214 **Cloud Print Manager:** the software component that implements the interface
215 between the Print Service Device (Printer) and a cloud-based environment for
216 registration of the Printer; and that implements the interface between the Printer and

217 one or more cloud-based components, called Cloud Print Services, for all Semantic
218 Model Print Service [PWG5108.01] elements and operations and other extensions
219 for Cloud Printing.

220 **Cloud Print Service:** a cloud-based software component that implements the
221 Service supporting Client submission of Semantic Model Print Service requests. A
222 Cloud Print Service communicates with one and only one Cloud Print Manager and
223 is created when the Device is registered with the cloud-based environment. The
224 Cloud Print Service acts as a cloud-based intermediary between the Client and
225 Cloud Print Manager.

226 **Cloud Scanning:** from the Job Originators' viewpoint, an arrangement that uses
227 Cloud-based components to allow a User to locate a Scan Service appropriate to the
228 User's needs and access rights, to submit a Scan Job Request intended for eventual
229 processing by that Scan Service, and to query that status of the request and the
230 resulting Scan Job. However, this PWG Cloud Imaging model is structured to allow a
231 User with the proper credentials and subject to other restrictions of the Cloud
232 environment, to submit any Scan Service request defined in the PWG Semantic
233 Model [REF] to the Cloud Scan Service.

234 **Cloud Scan Client (Client):** the software component that implements the interface
235 between the User and the cloud-based Cloud Scan components, including
236 association with the cloud-based environment, for all Semantic Model Scan Service
237 elements and operations.

238 **Cloud Scan Manager:** the software component that implements the interface
239 between the Scan Service Device (Scanner) and a cloud-based environment for
240 registration of the Scanner; and that implements the interface between the Scanner
241 and one or more cloud-based components, called Cloud Scan Services, for all
242 Semantic Model Scan Service [PWG5108.01] elements and operations and other
243 extensions for Cloud Scanning.

244 **Cloud Scan Service:** a cloud-based software component that implements the
245 Service supporting Client submission of Semantic Model Scan Service requests. A
246 Cloud Scan Service communicates with one and only one Cloud Scan Manager and
247 is created when the Device is registered with the cloud-based environment. The
248 Cloud Scan Service acts as a cloud-based intermediary between the Client and
249 Cloud Scan Manager.

250

251 **Device:** An abstract object representing a hardware component that implements one
252 or more Imaging Services [PWG 5108.01].
253 1. Fax: A Device implementing Fax Services; a Fax Service Device.
254 2. Printer: A Device implementing Print Services; a Print Service Device.

- 255 3. Scanner: A Device implementing Scan Services; a Scan Service Device.
256 4. Single-function Device: A Device implementing a single service.
257 5. Multifunction Device: A Device implementing two or more services.

258 **Job Originator:** The User that submits the initial request to create the Job [PWG
259 5108.01].

260 **Registration:** the process by which a Device becomes known to the cloud-based
261 environment, resulting in the creation of a corresponding Cloud Fax/Print/Scan
262 Service.

263 **User:** As defined in the MFD Model and Semantics Standard [PWG 5108.01], Users
264 include the Administrators, Job Owners, Operators, members of the Job Owner's
265 group and other authenticated entities.
266

267 **3. Requirements**

268 **3.1 Rationale for Cloud Imaging Model and Requirements**

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

274 Cloud Imaging has many potential implementation methods to comply with the need
275 for security, and that the components can be located or contained within different
276 locations.

277 The cloud can be a private cloud, a public cloud, or some hybrid federation of the
278 two. The actual imaging device may be located at the users location, part of the
279 service provider, at a remote user's location, or remotely as a pay to image location.

280 **3.2 Consideration of Imaging Use Cases**

281 Cloud Imaging use cases require establishing a connection to a Cloud-based entity
282 (typically involving authentication and authorization of the prospective Job
283 Originator), although it is possible that this connection may not have been made
284 specifically for printing. In PWG Cloud Imaging, the User, operating through the
285 Client, interacts with a Cloud Imaging Service in the same way and using the same
286 operations with which he would interact with any network Imaging Service. That is,
287 once the connection to the appropriate Cloud Service (Fax, Print, Scan) is made
288 (using whatever methods are appropriate to the specific Cloud environment), from
289 the User/Client viewpoint, the imaging process follows the network imaging process,
290 and the use cases for network services (Fax, Print, Scan) apply.

291 Although the specifics of these use cases depend upon the imaging protocols used,
292 (i.e., the specific binding of the model described in this specification), these use
293 cases generally provide that a User can:

- 294 6. Determine the status of a selected Imaging Device
- 295 7. Submit a Job Request intended for eventual processing by that Device, and
- 296 8. Query that status of the request and the resulting Job

297 However, Cloud Imaging differs from ordinary network imaging environments in that
298 it involves three distinct sets of communications:

- 299 a. from the Client to the Cloud Service (Fax, Print, Scan) and
- 300 b. from the Cloud (Fax, Print, Scan) Service to the end Device through a Cloud
- 301 (Fax, Print, Scan) Manager.

302 c. From the Device to the Cloud through a Cloud (Fax, Print, Scan) Manager.

303 Further, because the Cloud (Fax, Print, Scan) Service to Cloud (Fax, Print, Scan)
304 Manager interaction typically involves communicating through a firewall that does
305 not allow the Cloud (Fax, Print, Scan) Service to initiate queries or transfers, this
306 interaction may require operations by which the Cloud (Fax, Print, Scan) Manager
307 asynchronously provides Device and Job information to the Cloud (Fax, Print, Scan)
308 Service and queries the Cloud Service whether there is information waiting for it to
309 request. When incorporating standard imaging use cases from the User viewpoint,
310 the Cloud Imaging model must address the implications of these use cases from the
311 Device and Client viewpoint.

312 **3.2.1 Fax Use Cases Ref Cloud Fax document**

313 **3.2.2 Print Use Cases Ref Cloud Print document**

314 **3.2.3 Scan Use Cases Ref Cloud Scan document**

315

316

317 **3.3 Cloud Imaging Functional Requirements**

318 By the definition of PWG Cloud Imaging, a transversal is required between the User
319 and the Cloud Service and between the Cloud Fax/Print/Scan Manager and the
320 Cloud Service. The User need not be part of the Cloud Service domain and is not
321 directly connected to the Imaging device domain and the Imaging device need not
322 be part of the Cloud Service domain. This section describes the functional
323 requirements for any Cloud Imaging end-to-end solution. These are requirements for
324 the environment in which the Model operates but not necessarily requirements for
325 the Model itself. Requirements for the Model components are identified in section
326 3.5, Design Requirements.

327 1. User, operating though a Client, to be able to connect to the Cloud Service from a
328 variety of devices, operating systems, and applications.

329 2. User to provide acceptable credentials to the Cloud Service

330 3. User to be able to select the job destination.

331 4. User to be able to submit a Job including a document (direct or by reference) and
332 the job attributes.

333 5. Appropriate Cloud Service to return a response that indicates the Job submission
334 is acceptable or rejected.

335 6. Cloud Service to return a status of job completed, or the job failed.

336 7. Imaging device to be registered with the Cloud Service by the Device Owner,
337 including the user rights associated with the device. User rights include paid
338 printing, and other device capabilities that may be restricted to certain users.

339 8. Imaging Device to provide to the Cloud Service it's attributes, including supported
340 document formats, paper sizes and types, finishing options, and operational status.

341 9. Imaging Device to initiate all communications with the Cloud Service.

342 10. When the Cloud Service has a job available for processing, the device to return
343 acceptance or rejection of the job.

344 11. Device to return operational status when requested

345 12. At end of processing, Device to return a completion status

346 13. If unable to complete job, or job is canceled, Device to return status indicating
347 such activity occurred.

348 14. All communications between the Client and the Cloud Service, and between the
349 Device and the cloud, to be made via a secure connection ensuring data integrity
350 and confidentiality.

351 15. Support and describe a Job ticket and Document Data retention policy, e.g.,
352 job document data is discarded immediately after processing, discarded after 1 day,
353 saved indefinitely, etc.

354 16. All interactions between the Device and the Cloud Service to be logged following
355 the common log format.

356 **3.4 Out of scope**

357 From the Charter of the Cloud Imaging working group [] and the recognition that
358 Cloud Imaging may use different paths and elements within the cloud that are not
359 within the province of the Printer Working Group, the detailed definition of the
360 following elements and aspects of Cloud Imaging is out of scope for this
361 specification, although the general functions performed by these things in Cloud
362 Imaging may be identified in the Model discussion.

- 363 1. Defining Cloud federation interfaces and associated protocols and
364 technologies.
- 365 2. Defining the interface between the physical Imaging Device and the component
366 that provides the interface between the Imaging Device and the Cloud (later
367 called the Cloud Fax/Print/Scan Manager); this component may be part of the
368 Imaging device in which case it is an “internal” interface; or it may be external,
369 possibly serving multiple physical Imaging Devices, in which case it is assumed
370 to use already standardized Imaging Device interfaces.
- 371 3. Defining new protocols for authentication, authorization, and access control
372 (AAA), enumeration, -transport, notification, or device management.
- 373 4. Defining new document file formats.
- 374 5. Defining new abstract job tickets.
- 375 6. Defining specific interfaces within the Cloud Environment established to
376 support Cloud Imaging (later termed the Cloud service).
- 377 7. Defining the interface by which Imaging Devices are registered with the Cloud.
- 378 8. Defining the interface by which Users, including potential Job Originators are
379 associated with the Cloud.
- 380 9. Defining the interface between the User and the local component that provides
381 the User’s interface with the cloud (the User Client), this being part of an
382 application (or operating system) than can be assumed to be proprietary.

383 3.5 Design Requirements

384 Because the PWG Cloud Imaging Model requires two asynchronous sets of
385 interactions to complete any User to Printer action, the design requirements of the
386 PWG Cloud Imaging Model are presented in terms of the requirements on Client-
387 side interactions between the User (operating though the Cloud Print Client) and the
388 Cloud and Device-side interactions between the Imaging Device (seen though the
389 Cloud Print Manager) and the Cloud. Considering the Out-of-Scope items, the
390 design requirements are limited to defining or referencing an existing definition of the
391 User Client to Cloud interface on the Client-side, and the Cloud Fax/Print/Scan
392 Service to Cloud Fax/Print/Scan Manager interface on the Device-side. These
393 definitions will, however, assume or impose some characteristics of the otherwise
394 out-of-scope components.

395 3.5.1 Client-side Design Requirements

396 The User, operating though a Client, must establish a connection with the Cloud
397 elements supporting the functions necessary for Cloud Imaging. As identified in 3.4,
398 the authentication and authorization of the User, and the methods by which the
399 printers that he can use are located are out of scope. Also, as with any network
400 imaging process, the interface between the User and the Cloud Fax/Print/Scan
401 Client is a function of the device operating system and/or the Users application and
402 as identified in 3.4 is out of scope.

403 With respect to the imaging specific aspects, the User and the Cloud Fax/Print/Scan
404 Client serve the same functions, exercise the same operations, and use one of the
405 same imaging protocols as any imaging process that is compatible with the PWG
406 Semantic Model as specified in the MFD Model and Common Semantics [PWG CS
407 5108.01]. Therefore, Client-side requirements are:

- 408 1. The Cloud Fax/Print/Scan Service follows the state and transition definitions for
409 a service as defined in Sections 7.1 and 7.2 of the MFD Model and Common
410 Semantics [PWG CS 5108.01],
- 411 2. The Cloud Fax/Print/Scan Service follows and the Cloud Fax/Print/Scan Client
412 recognizes the Job and Document states and transitions as defined in sections
413 7.2.2 and 7.2.3 of the MFD Model and Common Semantics [PWG CS
414 5108.01],
- 415 3. The Cloud Fax/Print/Scan Service supports the Basic MFD Interface Requests
416 and Responses as identified in Table 1 and described in section 7.3.1 of MFD
417 Model and Common Semantics [PWG CS 5108.01]; the Cloud Fax/Print/Scan
418 Client uses these requests and accepts the responses to the extent compatible
419 with the capabilities it is to supply to the User.

420 Cloud Fax/Print/Scan Service support of the administrative operations defined in
421 section 7.3.2 of MFD Model and Common Semantics [PWG CS 5108.01] is optional
422 and is NOT a requirement of the PWG Cloud Printing model as defined in this
423 specification.

424 **3.5.2 Device-side Requirements**

425 Although the registration of the printer with the Cloud Service, including
426 communication of device capabilities and possibly User access restrictions, is out of
427 scope, the communication of status and possibly changes in capabilities is not.

428 The communication between the Cloud Fax/Print/Scan Manager and the Device
429 could be the same as that between a Client and a Print Service were it not for the
430 probable presence of a firewall preventing the Cloud Fax/Print/Scan Service from
431 initiating requests of and submissions to the Device. Instead, an intermediary actor
432 call the Cloud Fax/Print/Scan Manager exists between the Device and the Cloud
433 Fax/Print/Scan Service to implement a set of operations that allow the
434 communication of device configuration and state information and job and document
435 state information to the Cloud Fax/Print/Scan Service that it cannot request; and the
436 communication of Job Request and Document data to the device that the Cloud
437 Fax/Print/Scan Service cannot submit.

- 438 1. The Cloud Print Service and the Cloud Print Manager follow the state and
439 transition definitions for a service as defined in Sections 7.1 and 7.2 of the
440 MFD Model and Common Semantics [PWG CS 5108.01],
441

- 442 2. The Cloud Print Manager follows and the Cloud Print Client recognizes the Job
443 and Document states and transitions as defined in sections 7.2.2 and 7.2.3 of
444 the MFD Model and Common Semantics [PWG CS 5108.01],
445 3. The Cloud Print Service supports a set of interface requests and responses
446 and the Cloud Print Manager uses these requests and accepts the responses
447 to allow communication of the following types of information:
448 a. Printer Capabilities, Configuration and Status.
449 b. Job Requests, including Job Tickets, Document Tickets and Document
450 Data
451 c. Job and Document Status
452 4. The interchange between the Cloud Print Manager and the Cloud Print Service
453 provides some method by which the Cloud Print Service can determine
454 whether a disruption in the communication has occurred.
455 5. The Cloud Print Manager provides and the Cloud Print Service supports
456 provisions to allow the synchronization of Job and Document status and the
457 update of Printer status in normal operation, and on recovery after occurrences
458 such as disruption of communication or hard reset of the Cloud Print Manager.
459 6. Although an optional capability, the Model provides for the Cloud Print Service
460 to notify the Cloud Print Manager that information is available or a request for
461 information is present and the Cloud Print Manager should contact the Cloud
462 Print Service.

463 **3.5.3 Transforms**

464 Transforms available in the device should be advertised.

465 **3.5.4 Privacy and security policies**

466 The device should not transmit any information that violates best practices for data
467 security.

468 **3.5.5 Logging**

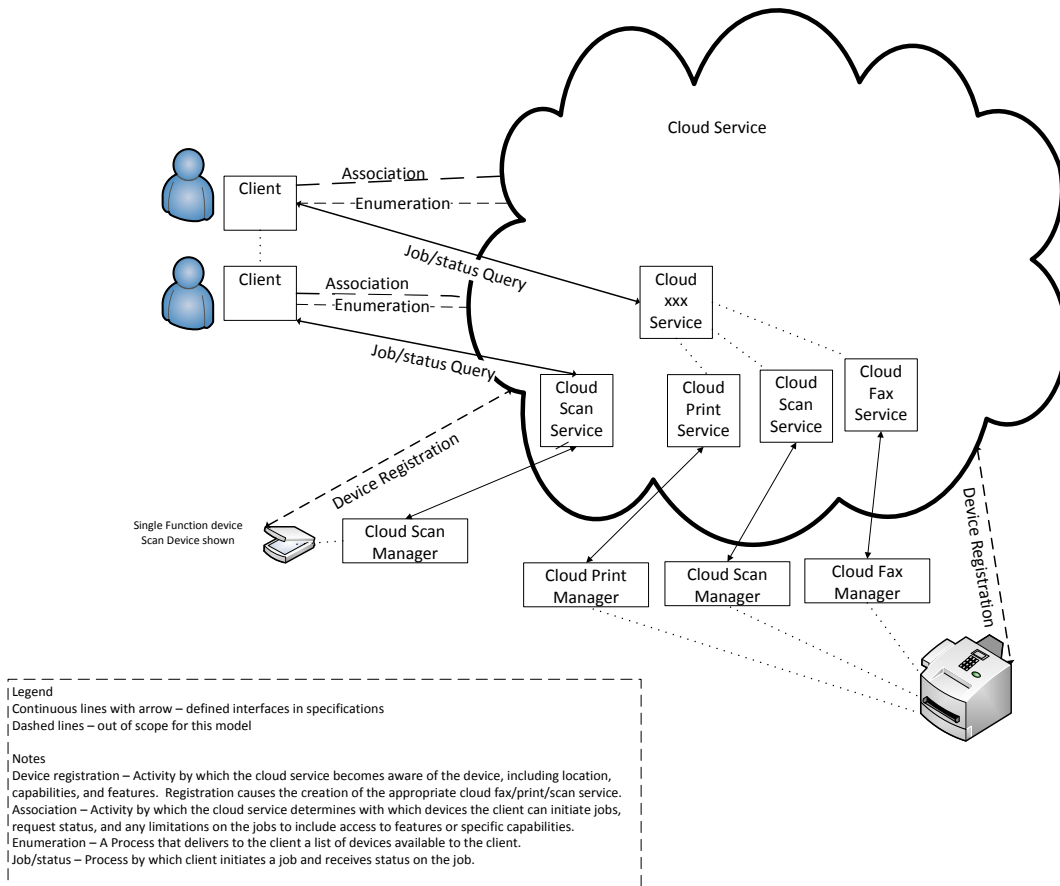
469 |

470 **4. Cloud Imaging Model**

471 **4.1 Cloud Imaging Model Overview**

472 An overall representation of imaging in a cloud environment is shown in Figure 1. In
473 a cloud environment, an individual Client may not be aware of the components and
474 services needed to enable imaging with a device that may be located at an external
475 location, including appropriate tracking, security, and transforms required to produce
476 and deliver the requested document. The operations are described in the specific
477 document for each of the services.

478 On the Device-side, the device is registered with the Cloud service, this process
479 provides the Cloud Service with the details about the Device. The Cloud Service
480 then creates a Cloud Fax/Print/Scan Service which will respond to requests initiated
481 from the Cloud Fax/Print/Scan Manager. On the Client-side, the user connects to
482 the Cloud Service and is provided an enumerated list of available devices. The User
483 can select a Printer represented by the Cloud Print Service by location, or by any
484 desirable attribute(s). The user submits a job to the selected Cloud Print Service.
485 The Cloud Print Service may perform a Transform or other modification to the Print
486 Job prior to placing the Print Job in a list of available Jobs. The Cloud Fax/Print/Scan
487 Manager initiates the communication with the Cloud Fax/Print/Scan Service and
488 processes requests from a list Jobs. During and after completion of the
489 Fax/Print/Scan Job, The Cloud Fax/Print/Scan Manager sends the status information
490 to the Cloud Fax/Print/Scan Service. The User can determine current status of the
491 Fax/Print/Scan Job from the Cloud Fax/Print/Scan Service.



492
493

494
495

Figure 1 Cloud Imaging functional Model

496 **4.2 Sequence Diagrams**

497 Sequence drawings are available for each of the specific services in the reference
498 document.

499 **4.2.1 Cloud Faxing Requirements and model**

500 **4.2.2 Cloud Printing Requirements and model**

501 **4.2.3 Cloud Scanning Requirements and model**

502 **4.2.4 Cloud Device Management Requirements and model (future)**

503 **4.3 Cloud Imaging Objects**

504 These objects are specific to the cloud

505 **4.4 Cloud Imaging Operations**

506 These operations are specific to the cloud

507 **4.5 Cloud Fax/Print/Scan Services**

508

509 **5. Conformance Requirements**

510 Provide a list of conformance requirements for the document.

511 **6. Internationalization Considerations**

512 For interoperability and basic support for multiple languages, conforming
513 implementations MUST support the UTF-8 [RFC3629] encoding of Unicode
514 [UNICODE] [ISO10646] and the Unicode Format for 1258 Network Interchange
515 [RFC5198].

516 **7. Security Considerations**

517 Cloud Imaging requires device and job status, job ticket and imaging data to
518 transverse a firewall. All communications with the Cloud Service will be initiated by
519 the Cloud Fax/Print/Scan Manager.

520 Reference document to follow????

521 **8. IANA Considerations**

522 There are no requirements for IANA registration for this specification.

523 **9. References**

524 **9.1 Normative References**

525 [REFERENCE] F. Last author list or standards body, "Title of referenced
526 document", Document Number, Month YYYY, URL (if any)

527 **9.2 Informative References**

528 [REFERENCE] F. Last author list or standards body, "Title of referenced
529 document", Document Number, Month YYYY, URL (if any)

530 **10. Authors' Addresses**

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535 The authors would also like to thank the following individuals for their contributions to
536 this standard:

537

538 **11. Change History**

539 | [PWG Secretary: This section must be removed when Document is approved]

540 **11.1 Initial Revision: February 6, 2013**