



BSI Standards Publication

Postal services — Open standard interface between image controller and enrichment devices (OCRs, video coding systems, voting systems)

National foreword

This Published Document is the UK implementation of CEN/TS 15448:2014. It supersedes DD CEN/TS 15448:2006 which is withdrawn.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

**Postal services - Open standard interface between image
controller and enrichment devices (OCRs, video coding systems,
voting systems)**

Services postaux - Interface standard ouverte entre le
contrôleur d'images et les dispositifs enrichis (OCR,
systèmes d'encodage vidéo, systèmes de votes)

Postalische Dienstleistungen - Offene Normschnittstelle
zwischen Bildbearbeitung und Anreicherungsgeräten (OCR,
Videocodierungssysteme, Abstimmungssysteme)

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Foreword

This document (CEN/TS 15448:2014) has been prepared by Technical Committee CEN/TC 331 "Postal services", the secretariat of which is held by NEN.

The document supersedes CEN/TS 15448:2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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Introduction

There is a growing demand on the postal operators to combine parts of their sorting automation equipment from different suppliers to optimize performance. In the past this has led to project specific interfaces being negotiated between one postal operator and one or multiple suppliers. These project-specific interfaces were developed by the suppliers and maintained for an agreed period of time. This approach has several disadvantages:

- The interface is derived from an interface that was not intended to be open,
- The interface is developed for a single project and works only in the context of that project (extra costs),
- Each participating supplier has to implement the interface (multiple effort),
- Experience shows that integration of components with project-specific interfaces is complex and expensive,
- Project-specific interfaces are not integrated into the product line and once the initially agreed maintenance period is over it may be difficult and expensive to maintain and/or may hinder the adoption of equipment upgrades.

This has led to “open interfaces” defined by one supplier. These still have the disadvantage of being in product use by only one supplier.

Within a group of postal operators and suppliers it was decided to develop a set of “open standard interfaces” which will be developed by the suppliers and referred to by the postal operators. The benefits of these interfaces are expected to be that they:

- are fixed in an international standard (with change control);
- are agreed and implemented by major suppliers;
- are agreed by customers and therefore used in calls for tenders;
- will result in net savings with the high initial development effort and consequent higher basic equipment prices being more than offset by reduced project development, integration and maintenance costs;
- will minimize the need for project integration effort by reducing implementation timescales;
- will increase competition between suppliers by stimulating product improvements.

This document covers the interface between an image controller and so called enrichment devices (OCR, Video Coding System or Voting System).

The communication partners of this interface will be called Image Controller (IC) on the one side and Enrichment Device (ED) on the other side.

Other work items (subject to agreement of CEN/TC331 and the UPU Standards Board) will be defined to cover other areas as and when the need is identified and the resources for development become available. A separate project group for each interface will undertake the work.

1 Scope

The purpose of this Technical Specification is to define the requirements of the OCR/VCS Standard interface and to convey these requirements in context to the reader.

This document is arranged under 4 main clauses as described in Figure 1:

- UCM (Use Case Model) describes the use cases for the IC/ED Interface using sequence diagrams with messages.
- IDD (Interface Design Description) defines the data model for the IC/ED interface.
- SDD (System Design Description) defines the mandatory specification of the IC/ED interface in terms of architecture, services and behavioural models. In the Common Part of this clause no middleware or transport layer is specified. The common part of this clause is intended to be middleware-independent.
- SDD-TCP/IP, SDD-CORBA, in these specialized clauses. The specifications for 2 compatible transport solutions TCP/IP, CORBA are provided. Further middleware solutions (such as SOAP) can be added when available, provided that they are fully compatible with the Common Part.

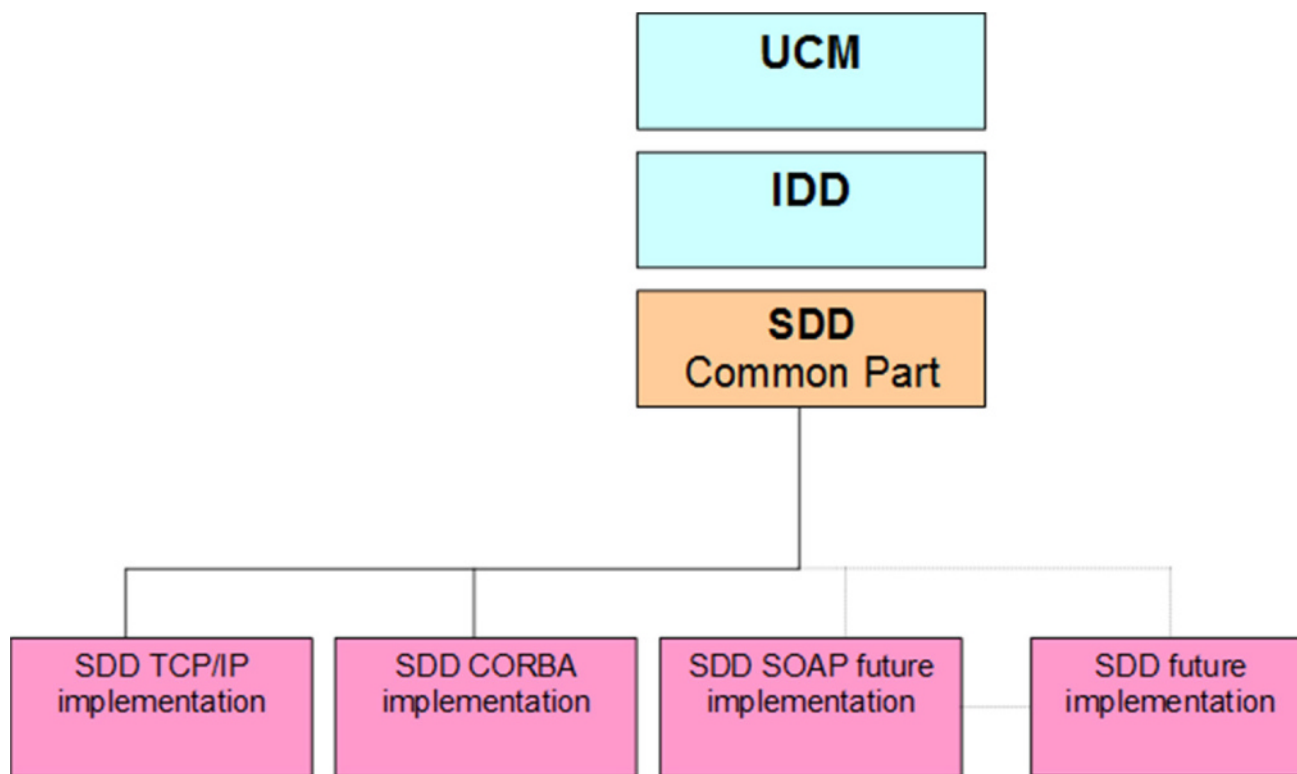


Figure 1 — IC/ED Interface Document Structure

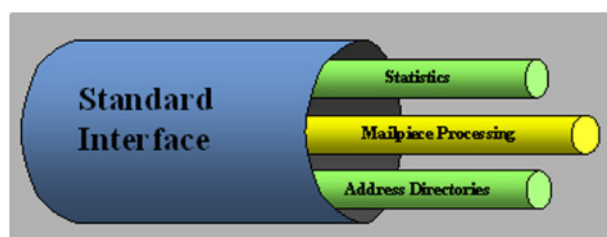


Figure 2 — Interface environment of an Enrichment Device

As shown on Figure 2, there are many interfaces from an Enrichment Device to the rest of the system. This document is only concerned with the **Mailpiece Processing** part of the complete Standard Interface.

The mailpiece processing is concerned with the passing of a mailpiece to an Enrichment Device for processing.

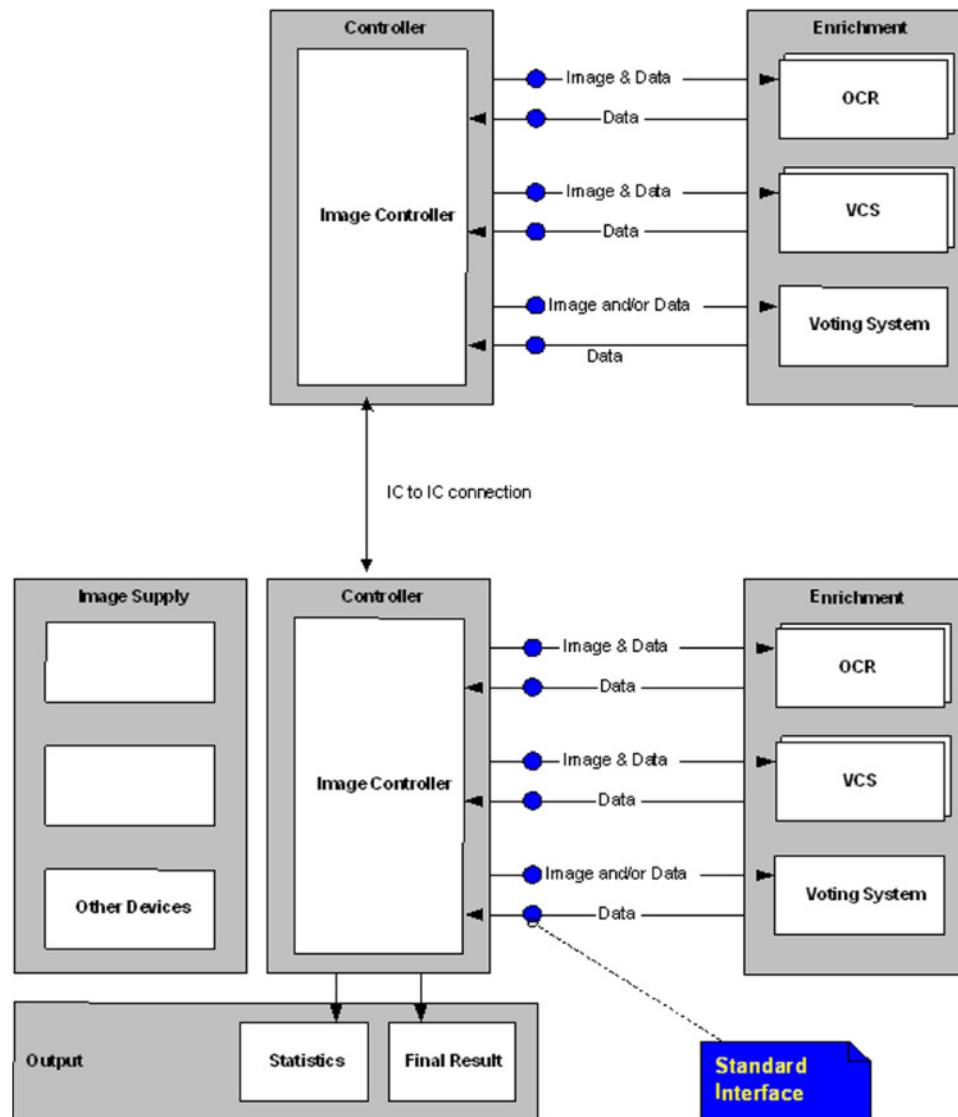


Figure 3 — System model

Figure 3 depicts the system model of an Enrichment Device. As visible on the figure, an Enrichment Device is one of:

- an OCR:

a single or a pool of automatic recognition and interpretation engines, which are capable of retrieving information from an image of a mailpiece without human intervention;

- a VCS:

a single or a pool of video coding desks, which produce results from images of mailpieces; all tasks related to the management of the coders and the coding desks are encapsulated within the VCS system, or are accessible via interfaces which are outside the scope of the interface described within this document;

— a Voter:

a system which can determine the most appropriate result for a mailpiece using data and/or an image of a mailpiece; typically, a voter determines the most appropriate result from two or more results.

This document therefore covers the **Mailpiece Processing** interface between the **Image Controller** and the **Enrichment Devices**.

The document describes the requirements in the case of **real-time enrichment**: operational mode of an Enrichment Device, where the ED replies within the specified expiration time to the IC; the IC has to keep track of all mailpieces waiting for a reply from an ED. The ED does not keep persistence of mailpieces outside a channel connection with the IC. The ED has to have the processing power available to enrich a mailpiece. There is one and only one response for a mailpiece.

A later version of the document shall describe the case of **deferred enrichment**: operational mode of an Enrichment Device, where the ED may pre-request mailpieces from the IC. The ED has to keep persistence of the mailpiece to enrich it later and keep the result available for a result request from the IC. There is no response expected by IC from the ED.

The interface between Image Controller and Image Controller is NOT part of this document.

Furthermore, there may be many IC connected to many ED's, as shown in the following object model:

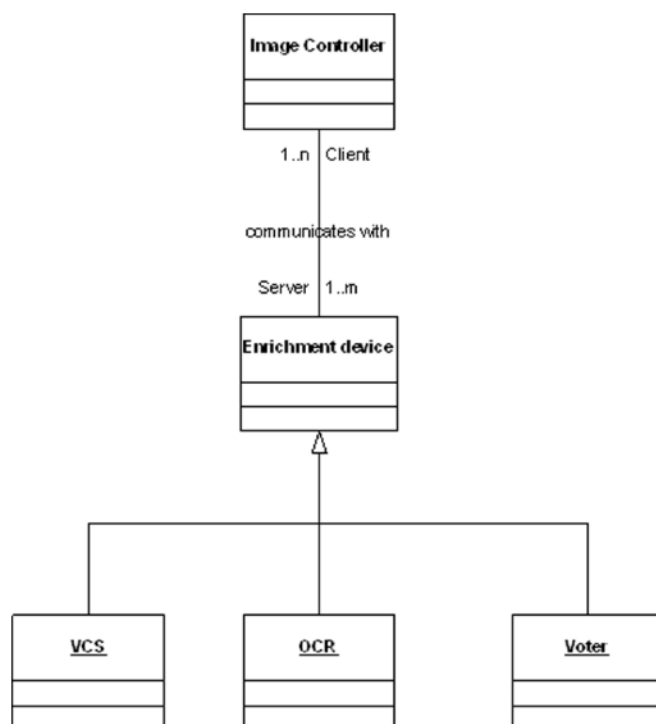


Figure 4 — Communication relationship between IC and ED

The submission strategy in case of one IC connected to many ED's is not part of the interface. It is for optimizing the mail flow in case of identical ED's, or for defining the order in which different ED's are activated (cascaded versus parallel submission).

The submission strategy of the IC shall be part of the specification and certification of the IC, which is not part of this document.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

actor

coherent set of roles those users of use cases play when interacting with these use cases.

Note 1 to entry: An actor has one role for each use case with which it communicates. See [UML].

3.2

attributes

non-image information related to a mailpiece

3.3

coding desk

computer or terminal equipped with a software to display images of mailpieces, and designed for a human operator (video coder) to enter information about the mailpiece

3.4

component

software unit with a defined interface; might contain other components

3.5

data element

simple data type

3.6

data object

assembly of elements [1..*] and/or other data objects; recursive type

3.7

enrichment

process of generating new information about a mailpiece

Note 1 to entry: Any information about the mailpiece may be used in this process, such as the image, image information or result data. However, the use of an image is not compulsory.

3.8

enrichment device

ED

system designed to enrich information about mailpieces

3.9

flow control

principle of sending images of mailpieces from an IC to an ED: either on request of the ED ("request" mode), or at a pace defined by the IC, with emission suspended/resumed on request by the ED

3.10

image

data acquired by the Image Supply and stored as part of the mailpiece

3.11

image controller

IC

system designed to handle the flow of images and data issued by the Image Supplies and sent to the Enrichment Devices

Note 1 to entry: The Image Controller also controls the results from image enrichment.

3.12

infrastructure data

basic information, such as identification references which an Image Controller and Enrichment Device require in order to communicate effectively

EXAMPLE Letter ID, Submission ID.

3.13

mail object

letter, Flat, Parcel, Postcard etc.

3.14

mailpiece

information stored about a single physical mail item (letter, flat or parcel) in an IC

3.15

mailpiece data

information which describes attributes of the physical mailpiece which is used to aid and is a product of enrichment

EXAMPLE Mailpiece width & height, indicia information, address location, city name, sort code, etc.

3.16

offline

operational mode of a sorting machine, in which some processing of mail is done after the mail has been conveyed in the machine; there is a need for printing an ID-tag, to identify the mail for which a 2nd sorting pass is required

3.17

online

operational mode of a sorting machine, implying all the processing of mail is done while the mail is conveyed in the machine; there is no need for printing an ID-tag

3.18

permanent Error

fatal error as indicated by the middleware or application layer.

Note 1 to entry: A non-fatal error may be considered to be a permanent error after repeated remedial handling.

3.19

result

outcome of enrichment

3.20

street

street keying (street name and/or house number in street)

3.21

system

components and relationships between these (interfaces, communication)

3.22

voter

system which can determine the most appropriate result for a mailpiece using data and/or an image of a mailpiece

4 Symbols and abbreviations

ED	Enrichment Device
GUI	Graphical User Interface
IC	Image Controller
ID	Identifier
IDD	Interface Design Description
OCR	Optical Character Recognition
PC	Post code
PM	Project Manager
ROI	Region Of Interest
SDD	System Design Description
UCM	Use Case Model
VCS	Video Coding System
W3C	World Wide Web Consortium
XML	eXtensible Markup Language
CORBA	Common Object Request Broker
TCP/IP	Transmission Control Protocol/Internet Protocol
SOAP	Simple Object Access Protocol

5 The Use Case Model (UCM)

5.1 General

The **Use Case Model** (UCM) defines the requirements of the CEN OCR/VCS Standard interface. The document utilizes UML use cases and other modelling techniques as well as textual information to convey the requirements.

This clause contains the following sections:

— Overall Description:

the use case model for the installation is described;

— Specific Requirements:

the use cases are described in detail including all supplementary requirements.

5.2 Overall Description

5.2.1 General

Unified Modelling Language has been used to describe the use case model. Details of UML can be found in [UML_OES], [UML_ALH] and [UML].

5.2.2 Use-Case Model Survey

5.2.2.1 General

The Use Case Model is separated into two groups of use cases: those which are relevant for the connection to an Enrichment Device system, and those which are relevant for managing and using a channel.

5.2.2.2 Connection Use Case Model

5.2.2.2.1 General

The connection use cases (Figure 5) apply to the Enrichment Device as a complete component. They enable a connection to be established and channels to be opened as well as the status exchange of the complete Enrichment Device.

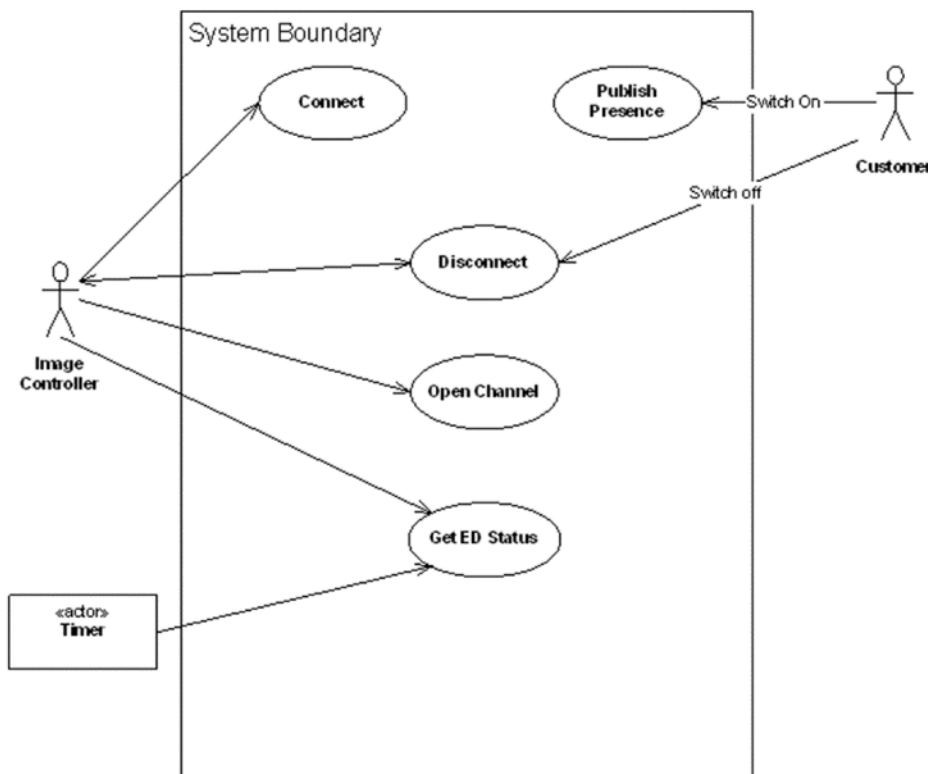


Figure 5 — Connection use cases

5.2.2.2.2 Actors

Name	Description
Image Controller	Software: The Image Controller is a complete software system which is possibly made up of many software components deployed on multiple hardware nodes. The IC is responsible for distributing images from the image sources to the Enrichment Devices and handling the results which are generated. The IC is responsible for the strategy for distributing the images.
Customer	Human: The Customer actor is a human who is able to start and stop the components.
Timer	Software: A timer which triggers events at defined intervals.

5.2.2.3 Use Cases

ID	Name	Description
UC001	Publish Presence	The Enrichment Device presents its presence to the Image Controller when it is switched on. Following strict client-server rules, the ED (the server) is passive and is connected-to by an IC (client).
UC002	Connect	The IC detects an ED which it wishes to utilize for processing mailpieces. It connects to the ED in order to use the processing capabilities of the ED. During the connection, the capabilities of the ED are exchanged with the IC.
UC003	Disconnect	A disconnect is bi-directional. A disconnect implies closing any opened channel within the connection
UC004	Open Channel	The Image Controller opens a coding channel. A channel defines the subset of the published capabilities The flow control is related to a channel.
UC005	Put ED Status	~~The ED indicates to the IC any relevant data about its status¹⁾~~
UC006	Get ED Status	The IC needs to know the global status of ED: to be able to go further in the transactions to display the status of the ED on the IC's GUI

5.2.2.3 Channel Use Case Model

5.2.2.3.1 General

These use cases (Figure 6) apply to a channel which has been previously opened. They allow the closing of a channel, the processing of mailpieces and the exchange of the channel status.

1) Deleted: This use case describes a message and not a use case. Remove this UC because the aims of the message can be covered by a) ED disconnects from IC is covered in UC - Disconnect. B) The need for the ED to know if the IC is present, can be fulfilled by checking if "Get ED Status" is executed or by observing its channels.

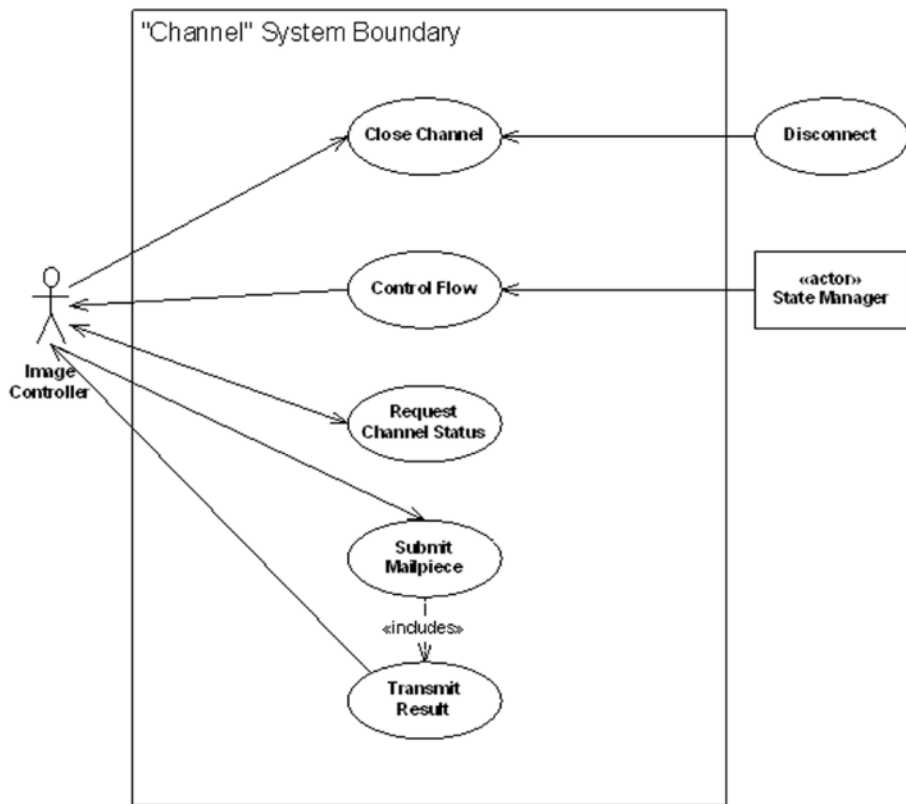


Figure 6 — Channel use cases

5.2.2.3.2 Actors

Name	Description
Image Controller	Software: The Image Controller is a complete software system which is possibly made up of many software components deployed on multiple hardware nodes. The IC is responsible for distributing images from the image sources to the Enrichment Devices and handling the results which are generated. The IC is responsible for the strategy for distributing the images.
Disconnect	Use Case : See UC003 - Disconnect
State Manager	Software: In a “real-time” processing environment the Enrichment Device shall have the ability to control the flow of images which is receives from the IC. This actor is used to represent the capacity of the ED. . When this capacity of the channel is exhausted, the flow of images from the IC is stopped and vice-versa.

5.2.2.3.3 Use Cases

ID	Name	Description
UC101	Close Channel	Close the channel and optionally discard any pending work
UC102	Control Flow	Control the flow of mailpieces from the Image Controller. See 5.2.3.11, Flow Control Model.
UC103	Request Channel Status	The IC requests from the ED any relevant data to manage a channel
UC104	Submit Mailpiece	A mailpiece is submitted to the ED for processing.
UC105	Transmit Result	A result is transmitted from the ED to the IC for every mailpiece which was previously submitted.

5.2.3 Assumptions and Dependencies

5.2.3.1 Image supply

Image supply is to be understood as a resource of images. Images might come from:

- Image capturing devices;
- Fed via network or from an image server;
- Other systems that can supply images.

5.2.3.2 Control

The Image Controller (IC) handles the flow of images and data. It also controls the results from image enrichment. If parts of an image are distributed to different Enrichment Devices it is the task of the IC to keep track of these parts and collect the returned data.

- There may be more than one ED connected to an IC.
- There may be more than one IC connected to an ED.

5.2.3.3 Output

The enrichment will produce results, which have to be delivered to other systems. This would normally be sorting machines or statistical systems.

5.2.3.4 Enrichment

This part of the system enriches the mail piece data. This might be done by Video Coding, OCR or Voters. The interface described in this document should allow for parts of an image to be distributed.

EXAMPLE The stamp region might be sent to a special stamp reader or the address region to an address reader.

5.2.3.5 Data Representation

Only *image relevant* data will be stored within the TIFF image. All postal data (mailpiece attributes) will be transferred using XML. Infrastructure data needed for communication between IC and ED will be transferred, not necessarily in XML – see Clause 6 for more detail.

Mailpiece attributes (in XML), image (in TIFF), and infrastructure data are transmitted together, excluding:

- embedding XML in TIFF

- embedding TIFF in XML
- referencing of the image in the XML data

Transferring images by reference shall be evaluated in a later version of the interface; this is not done in the current version of interface for following reasons:

- need to define the protocol for referencing
- added complexity of the interface: need to add a GetImage use case as an alternative flow of SubmitMailpiece
- added complexity of the interface to handle error cases, like ED failing to access the image

However, the need for transferring by reference exists:

- it may allow to reduce the network load within the ED
- it may allow to transmit different images (binary, greyscale, ROI...) depending on recognition step

5.2.3.6 Image Representation

All images are represented using the TIFF file format. The following restrictions apply:

- TIFF file format will conform to the TIFF Revision 6.0 (June 3rd 1992) [TIFF] Baseline specification.
- TIFF file format will utilize the extensions described in [TIFF_TN2] to facilitate the inclusion of grey scale images with baseline JPEG compression in the TIFF
- TIFF file will not contain any other data other than that which is required to describe the image itself.
- Refer to Clause 6 for a complete specification of the TIFF file format.

5.2.3.7 Channel Concept

The architecture of the interface is based upon the concept of virtual channels presented in Figure 7.

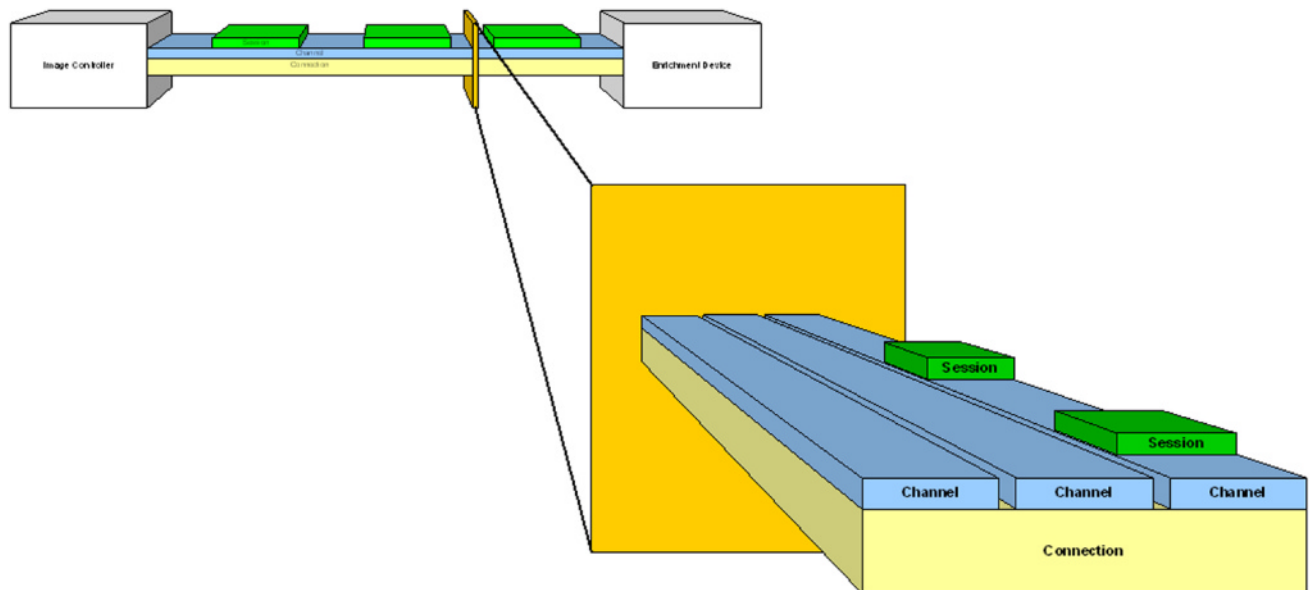


Figure 7 — Virtual channels concept

An interface between the Image Controller and an Enrichment Device consists of the following concepts:

— Connection:

There is only one connection between an IC and an ED. The connection is requested by the IC and enables the ED to allow or deny the connection. ED may need to register its features in a repository known by IC. The connection defines *infrastructure* information such as the version of the interface and all the capabilities of the ED. The connection applies to the logical connectivity of the devices. There is no restriction about the physical connectivity.

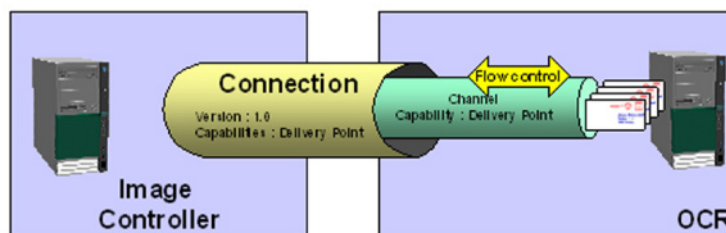
— Channel:

One connection may have many channels. A channel is a logical connection between an Image Controller and an Enrichment Device. A channel defines the processing type; each channel has its own flow control. A channel is associated to a unique bi-directional message and processing request queue. More than one channel can be opened at the same time between an Image Controller and a physical Enrichment Device.

— Session:

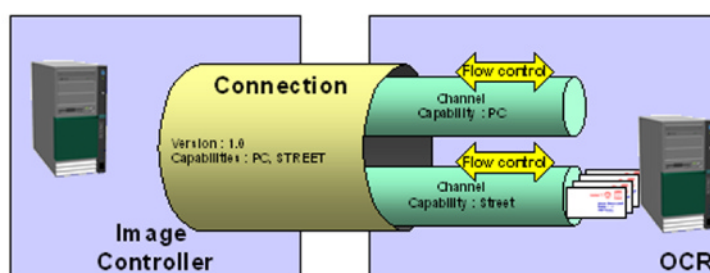
Sessions define a time periods, which are primarily used to control statistical information. Therefore it is not within the scope of this version of the Mailpiece Processing interface. The interface allows more than one simultaneous session to be active on a single channel. Since a session is a statistics reporting device, it may be defined on attributes other than time, for instance originating machine, or mail center.

Figure 8 and Figure 9 depict two typical uses of the channel concept, for an OCR system:



- An image controller and an OCR have a single connection. The connection defines the capabilities for the OCR, which are only "Delivery Point".
- Within this connection there is a virtual channel which defines a specialised capability. In this case it is also "Delivery Point".
- This channel has its own flow control.
- The images and attributes are passed via the channel.

Figure 8 — Channel concept use cases



- An image controller and an OCR have a single connection. The connection defines the capabilities for the OCR, which are "PC and Street".
- Within this connection there are two virtual channel which define a specialised capability. In this case there are "PC" and "Street" channels. These are opened because the OCR is capable of "PC" and capable of "Street".
- Each channel has its own flow control.
- Images and attributes are only passed via the Street channel because the OCR is configured to process only this flow at that moment.

Figure 9 — Channel concept use cases

5.2.3.8 Client/server model

As far as possible the interface shall adhere to a strict client/server model, where the IC is the client and the ED the server:

- all exchanges are initiated by the IC;
- there is one and only one reply for each request;
- the only exception are the exchanges required by the Flow Control mechanism (see 5.3.1.7, UC102 – Control Flow).

5.2.3.9 Server Selection Service

When the ED System is switched on and ready to be used by an IC, it publishes its presence to a Server Selection service. Depending on the middleware chosen the Server Selection service might be a UDDI service, Connection service, or simply a file. The Server Selection service will also provide a way to check for version compatibility. The IC will use the Server Selection service to discover the ED and retrieve the data necessary to establish a communication.

NOTE The ED acts as a service and therefore publishes its presence to the IC(s).

5.2.3.10 Connection Sequence

The diagram on Figure 10 shows the agreed (*CEN Suppliers Workshop 03/12/2003 – 05/12/2003 Barcelona*) connection model between an Enrichment Device and the Image Controller.

NOTE The sequence diagrams contained within these sections are for explanation purposes only and reflect the common understanding which was gained by the CEN Suppliers group during the development of the specification. The SDD in 7 specifies the behaviour of the interface in detail using sequence diagrams.

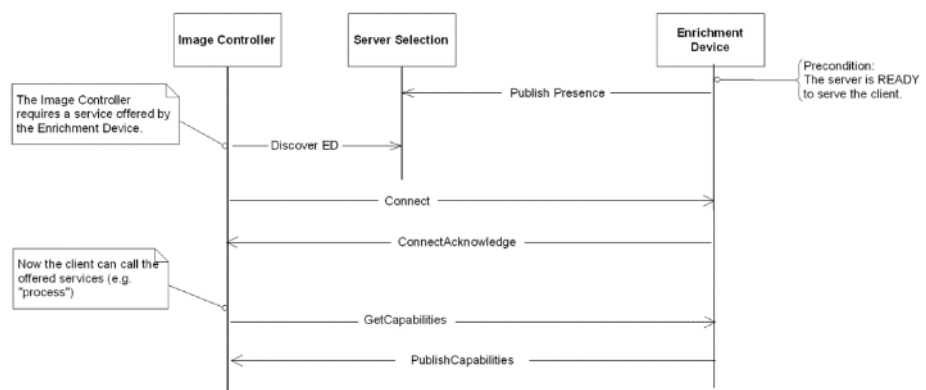


Figure 10 — ED- IC connection model

The Enrichment Device published its presence and the services it provides in a Server Selection service, when it starts running.

Insofar, the ED is the initiator of the connection.

The Image Controller tries to establish a connection to the ED through using the Server Selection service to discover the desired service. The ED can accept or deny the connection request.

After a connection has been established, the IC requests the capabilities of the ED; the ED returns its capabilities.

The capabilities should describe the full functionality of the ED, not considering temporary conditions derived for example by the status of the Video coding pool.

5.2.3.11 Flow Control Model

The flow control between an Enrichment Device and the Image Controller can be based on one of two possible models, request or semaphore model. The model-of-choice selected in the suppliers workshop (*CEN Suppliers Workshop 03/12/2003 – 05/12/2003 Barcelona*) is the semaphore model; this decision is logically linked to the decision of declaring the IC as the client and the ED as the server, as this simplifies the transactions between ED and IC and helps sticking to a “pure” client/server model.

The major shortcoming of this model is the possible “overflow” of the ED, while the IC has not processed the flow control request; this is critical in case of on-line video coding and has been solved by setting a limit in the number of pending transactions.

The Image Controller opens the required channel (depending upon the mailpieces which require processing).

The Enrichment Device allows or denies the open channel request. Mailpiece processing may now start.

The sequence diagram presented on Figure 11 shows how the IC can open the channel for the capability C1, and how the flow control (PutChannelStatus) can be used by the ED over this channel to request mailpieces.

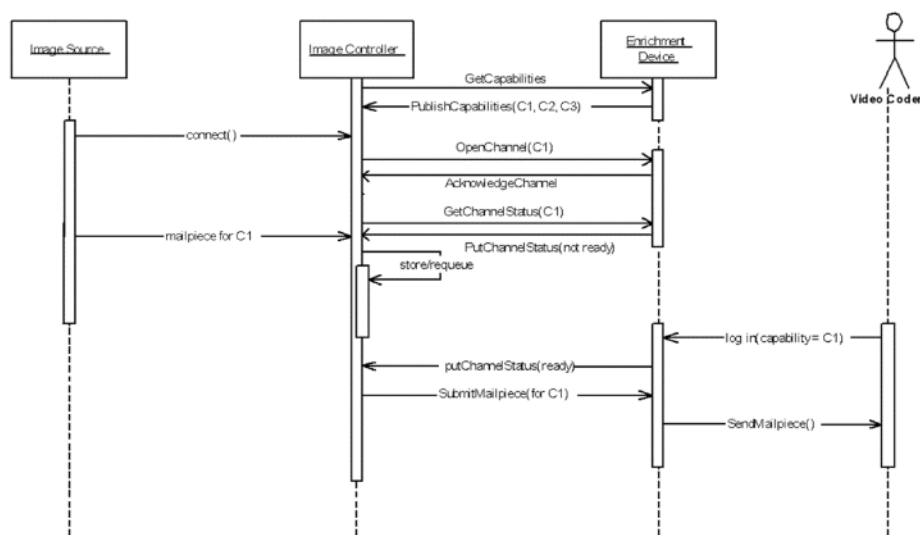


Figure 11 — Open a channel for certain capabilities

The diagram presented on Figure 12 shows how the ED regulates the flow of mail pieces submitted by the IC

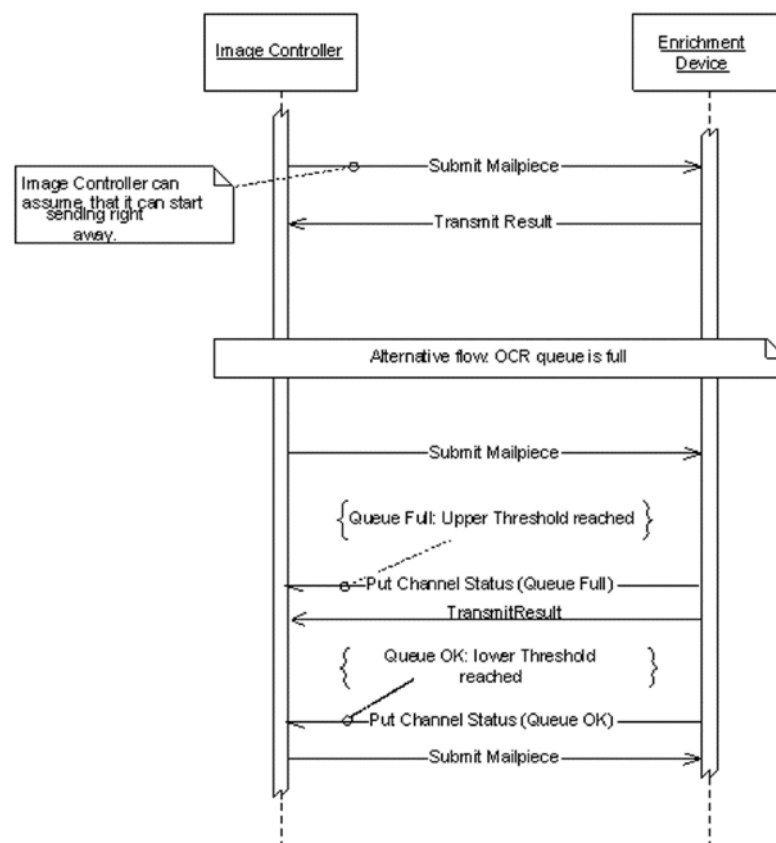


Figure 12 — Mail pieces flow regulation

In the semaphore model, the Image Controller submits mailpieces to the Enrichment Device until the Enrichment Device signals that the Image Controller should stop.

The Enrichment Device maintains an internal queue which has upper and lower threshold limits. When these are reached, the Image Controller is instructed to stop or start submitting mailpieces respectively.

Results may be transmitted out of sequence.

The Enrichment Device may dispatch the images internally for parallel processing, but the enrichment operations (OCR or video coding) will not necessarily complete in order. Since the IC has to keep track of outstanding requests anyway, it should be able to handle out-of-order result transmissions.

In case of many ICs connected to the same ED, the ED shall guarantee one queue for each IC. If there is a maximum number of IC connections (or Channels) acceptable for an ED, and if this maximum number of channels has been reached, the next Channel request should be refused by the ED. The ED has the responsibility to manage load balancing between the different channels.

After closing of a channel, neither the IC nor the ED has to keep track of any outstanding transaction. The ED shall delete the relevant images.

5.3 Specific Requirements

5.3.1 Use-Case Reports

5.3.1.1 UC001 - Publish Presence

5.3.1.1.1 Brief Description

When an Enrichment Device is switched on and ready to be used by an IC, it publishes its presence in a Server Selection service which the IC can use to discover Enrichment Devices which are available.

5.3.1.1.2 Actors

Customer.

5.3.1.1.3 Flow of Events

5.3.1.1.3.1 Basic Flow

The basic flow covers the scenario where no exception handling is required. The Server Selection service for publication is available and can be reached by the ED, and there is no existing entry for this ED.

- 1) The customer switches on the Enrichment Device
- 2) The Enrichment Device starts and prepares itself to handle connection requests from the Image Controller.
- 3) When the Enrichment Device is ready to handle connection requests, it publishes its presence in the Server Selection service which is used by the IC to discover available Enrichment Devices.

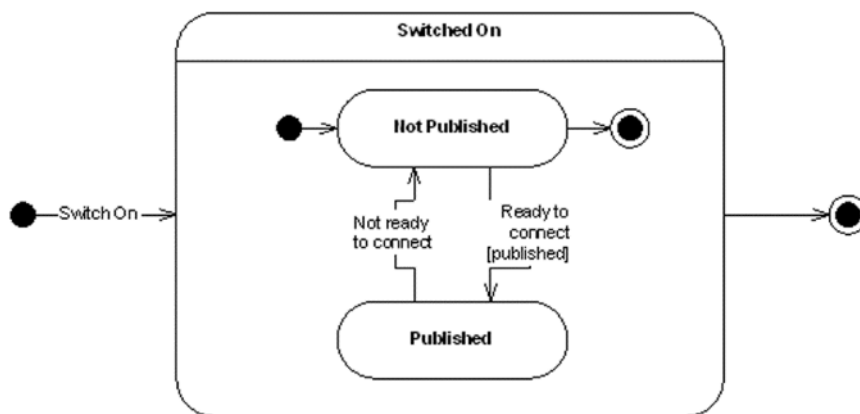


Figure 13 — State diagram ED

The state diagram (Figure 13) shows that the ED is only published when it is ready to accept a connection request.

If it is not ready to handle a connection request, it is not published.

5.3.1.1.3.2 AF001-01: Enrichment Device cannot register

If the Enrichment Device cannot register into the Server Selection service, it will attempt to register again after a delay defined by the supplementary requirement Publish_Retry_Delay. Until the registration is successful the Enrichment Device will remain unavailable for the Image Controller.

5.3.1.1.3.3 AF001-02: Server Selection Service contains an entry for the Enrichment Device

This alternative flow is middleware dependent.

5.3.1.1.3.4 AF001-03: Server Selection Service Restarted

This alternative flow is middleware dependent.

When the Server Selection service is restarted, the references are not guaranteed to be available. There is no requirement that the Server Selection service is persistent. Therefore the Enrichment Device shall ensure that its current reference is entered correctly in the Server Selection service at all times. See SR 001-03.

5.3.1.1.4 Special Requirements

SR ID	Description
SR 001-01	If the Enrichment Device cannot register with the Server Selection Service, it will re-attempt after a time defined by the supplementary requirement Publish_Retry_Delay. Registration attempts can be repeated indefinitely.
SR 001-02	An Enrichment device shall remove its entry in the Server Selection service when it is stopped intentionally. In crash situations this behaviour is not mandatory.
SR 001-03	The Enrichment device shall ensure that its entry in the Server Selection service is published and correct

5.3.1.1.5 Pre-Conditions

Pre ID	Description
PRE001-01	The ED is configured with the information required to reach the Server Selection service (e.g. IP and Port number). In a distributed system, there is only one logical Server Selection service.
PRE001-02	The Server Selection service is running and is accessible by the Enrichment Device.

5.3.1.1.6 Post-Conditions

Post ID	Description
POST001-01	The Enrichment Device is published in the Server Selection service.
POST001-02	Any old entries for the Enrichment Device are overwritten with the new information.

5.3.1.2 UC002 - Connect

5.3.1.2.1 Brief Description

When an Image Controller wishes to use the services of an Enrichment Device which is published in the Server Selection Service (see [UC001 – Publish Presence](#)), it connects to it as described by this use case.

When this use case has been completed, the Image Controller can open channels for the processing of mailpieces.

This use case enables an Image Controller and Enrichment Device to communicate with each other and for the Enrichment Device to inform the Image Controller of its capabilities.

5.3.1.2.2 Actors

— Image Controller.

5.3.1.2.3 Flow of Events

5.3.1.2.3.1 Basic Flow

The basic flow (Figure 14) describes the scenario when the Image Controller looks for or discovers an Enrichment Device which may be used by the Image Controller. The Image Controller requests a connection and this is allowed by the Enrichment Device.

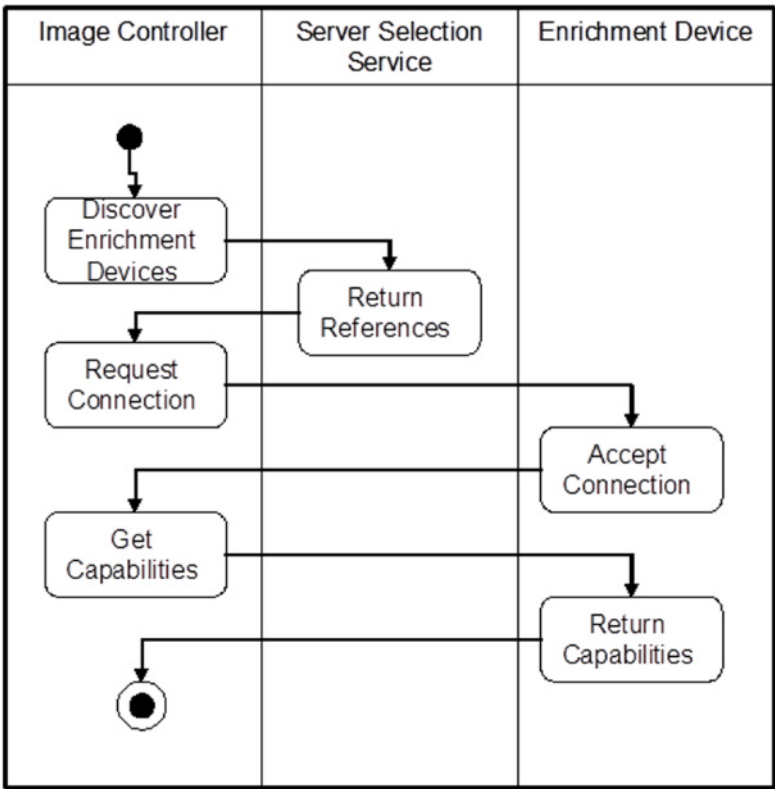


Figure 14 — Connect basic flow

- The Image Controller discovers Enrichment Devices in the Server Selection service. The Image Controller may scan for available devices or look explicitly for one.
- The Server Selection Service returns a reference which can be used by the Image Controller to communicate directly with the Enrichment Device.
- The Image Controller requests a connection to the Enrichment Device. The connection request allows the Enrichment Device to check if this Image Controller is already connected and for example any licensing issues. The connection request by the Image Controller includes the following information:

- 1) The manufacturer of the Image Controller in text form (e.g. "Siemens", "Solystic", "Lockheed" etc.)
- 2) The interface version being used by the Image Controller. This will consist of a major and minor number.
- 3) A unique identifier of the Image Controller which is valid within the scope of the Enrichment Device. This means that the identification does not have to be country wide unique unless every Image Controller in a country can connect to an Enrichment Device.
- d) The ED checks the legality of the connection (e.g. licenses) and acknowledge the connection by returning its status to the machine to the IC. The Connect Status information includes:
 - 4) The state of the connection (connected, not connected) including a reason if the connection request is refused.
- d) Now the Image Controller is connected to the Enrichment Device, but it does not know what mailpieces can be processed by the Enrichment Device. It therefore requests the capabilities of the Enrichment Device. The information which is returned will enable the Image Controller to open specific channels for processing mailpieces. The Image Controller requests the capabilities from the Enrichment Device.
- e) The Enrichment Device returns a complete list of capability sets. Capabilities are grouped into capability sets.

Each capability set is identified with the following information:

- 1) Capability set name by which the capability set will be identified in later transactions.
- 2) Device Type which is at least one, or a combination of OCR, VCS or Voter.
- 3) The capabilities which comprise the capability set. The capabilities are project specific. A capability is identified by List Entry 1):
 - i) Capability name
 - ii) The mailpiece types which may be passed over a channel opened for this capability set (Letter, Flat, Parcel). This list is extensible. At least one mailpiece type shall be set. Setting a mailpiece type means that the Enrichment Device can handle this type of mailpiece. The IC may send images with a subset of the mailpiece types.
 - iii) The image types (grey level, binary, colour). This list is extensible. Setting an image type means that the Enrichment Device can handle this type of image. If one or more image types are set, the IC shall send images which may be a subset of the image types.

Below are examples of capability sets and their capabilities:

Table 1

Capability Set for OCR which always reads recipient address as deep as possible. It can only process letter mailpieces but either grey or binary.										
Capability Set	Capability									
	Recipient									
OCR	{letter} {grey, binary}									

Table 2

Capability Set for OCR which can read Sender and Recipient addresses as deep as possible. It can handle letter and flat mailpieces, but only binary.									
Capability Set	Capability								
	Recipient	Sender							
OCR	{letter, flat} { binary}	{letter, flat} { binary}							
Submit Mailpiece Settings									
Submit mailpiece for Recipient coding only	X								
Submit mailpiece for Sender coding only		X							
Submit mailpiece for All processing	X	X							

Table 3

Capability Set for OCR which can read Sender and Recipient addresses to outward, inward or delivery point depths. It can handle letter and flat mailpieces, but only binary.								
Capability Set	Capability							
	Recipient Outward	Recipient Inward	Recipient Delivery Point	Sender Outward	Sender Inward	Sender Delivery Point		
OCR	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}		
Submit Mailpiece Settings								
Submit mailpiece for up to Recipient Delivery Point	X	X	X					
Submit mailpiece for Recipient and Sender Outward	X			X				

Table 4

Capability Set for VCS which can do ROI, PC, Street, ROI & PC, and PC & Street coding on letters and flats but only on binary images								
Capability Set	Capability							
	ROI	PC	Street	ROI & PC	PC & Street			
PC Letter		{letter} { binary}						
PC Flat	{ flat} { binary}	{ flat} { binary}		{ flat} { binary}				
Inward Only			{letter, flat} { binary}					
Address Coding Letter		{letter } { binary}	{letter } { binary}		{letter } { binary}			
Address Coding All	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}	{letter, flat} { binary}		
Submit Mailpiece Settings								
Submit a Flat mailpiece for PC coding on the channel "Address Coding All"				X				
Submit a Letter mailpiece for PC coding only on the channel "Address Coding All"		X						

Submit a letter mailpiece for PC and Street coding on the "Address Coding Letter"		X	X					
---	--	---	---	--	--	--	--	--

Table 5

Capability Set for VCS which can do Inward and Outward coding on binary images of letters and flats.								
Capability Set	Capability							
	Outward	Inward	Combined					
Outward	{letter, flat} { binary}							
Inward		{letter, flat} { binary}						
Combined			{letter, flat} { binary}					
Submit Mailpiece Settings								
Submit a mailpiece for only outward coding on the "Outward channel"	X							
Submit a mailpiece for combined coding on the "Combined channel"			X					

A channel is opened by the Image Controller for a single Capability Set (see UC004 – Open Channel).

When submitting a mailpiece, the images shall match the Image Types and Mailpiece Types which are defined for the capability set. The Image Controller shall set the capabilities which are to be applied to the mailpiece when it is submitted. These are a subset of the published capabilities for the capability set (see UC104 – Submit Mailpiece).

5.3.1.2.3.2 AF002-01 Enrichment Device Rejects Connection Request

The steps a)...)c) from the basic flow are repeated.

- The ED checks the legality of the connection (e.g. licenses) and rejects the connection of the IC.
- The rejection defines the reason for reject in text form. The IC may not attempt to reconnect before the time period defined by the supplementary requirement Connect_Retry_Delay.

5.3.1.2.3.3 AF002-02: Same Image Controller Connects Again To Enrichment Device

The steps a)...)c) from the basic flow are repeated.

- The ED checks the legality of the connection (e.g. licenses), but notices that the IC is already connected (same manufacturer and IC ID).
- The ED disconnects the previously connected IC as described in AF003-02 Disconnect initiated by ED.

- c) The ED accepts the connection of the new IC.

There are two scenarios when this alternative flow is relevant:

- 1) A new IC is wrongly configured, and attempts to connect to the ED as an already existing IC. The error will be visible due to the fact that:
 - i) the original IC and the new IC will compete for the connection, resulting in alternate restarts;
- 2) An IC terminates without signalling its termination to the ED. This scenario is highly likely and does not indicate a severe error. When the IC restarts it will shut down its own “old” connection with its new one. Without this functionality, the IC will never be able to restart after such a termination.

5.3.1.2.3.4 AF002-03: Another Image Controller Connects to Enrichment Device

Multiple Image Controllers may connect to a single Enrichment Device. How the Enrichment Device handles multiple Image Controllers is implementation specific and does not affect the interface.

5.3.1.2.4 Special Requirements

SR ID	Description
SR 002-01	During the connection, identifiers are exchanged which allows the M:N relationship between Enrichment Devices and Image Controllers.
SR 002-02	There is only one connection between an Enrichment Device and an Image Controller.
SR 002-03	An Image Controller may only connect once to an Enrichment Device. See AF002-02 as to when the Enrichment Device will accept a connection attempt from an already connected Image Controller.
SR 002-04	If the Image Controller receives at anytime a permanent error (e.g. Corba or SOAP exception), it will determine again the reference of the Enrichment Device: the connection scenario will be re-performed.
SR 002-05	An Image Controller may connect to more than one Enrichment Device.
SR 002-06	More than one Image Controller may connect to an Enrichment Device.
SR 002-07	Capability Set & Capability names are project specific and are defined in the project specific extension of the IDD (6). All Enrichment Devices within a project shall use the same identifications for the same capabilities.
SR 002-08	The image controller is responsible for the discovery of Enrichment Devices who have published their presence in the Server Selection service, even after the image controller has started. The image controller shall periodically scan the Server Selection service for changes or additions.

5.3.1.2.5 Pre-Conditions

Pre ID	Description
PRE002-01	UC001 has been successfully performed.
PRE002-02	All hardware is correctly installed (i.e. Each ED and each IC has a unique IP address). Each IC and ED node can reach the other via a network connection.

5.3.1.2.6 Post-Conditions

Post ID	Description
POST002-01	The Image Controller knows the reference of the Enrichment Device.
POST002-02	The Enrichment Device knows the reference of the Image Controller.
POST002-04	The Image Controller knows of all the capabilities of the Enrichment Device.
POST002-05	The IC is connected to the ED.

5.3.1.3 UC003 – Disconnect

5.3.1.3.1 Brief Description

A disconnect may be initiated only by the Image Controller, on an already existing connection. An Enrichment Device can only disconnect from one, many or all Image Controllers by destroying its channel resources; an Enrichment Device cannot disconnect as such - rather it removes its services.

Reasons for initiating disconnect are:

- human intervention (like stopping the program, or switch off a computer);
- software crash;
- transport-layer error;
- application-level error (like data out of bounds);
- explicit request from the Image Controller.

5.3.1.3.2 Actors

- Image Controller.
- Customer.

5.3.1.3.3 Flow of Events

5.3.1.3.3.1 Basic Flow: Disconnect initiated by Image Controller

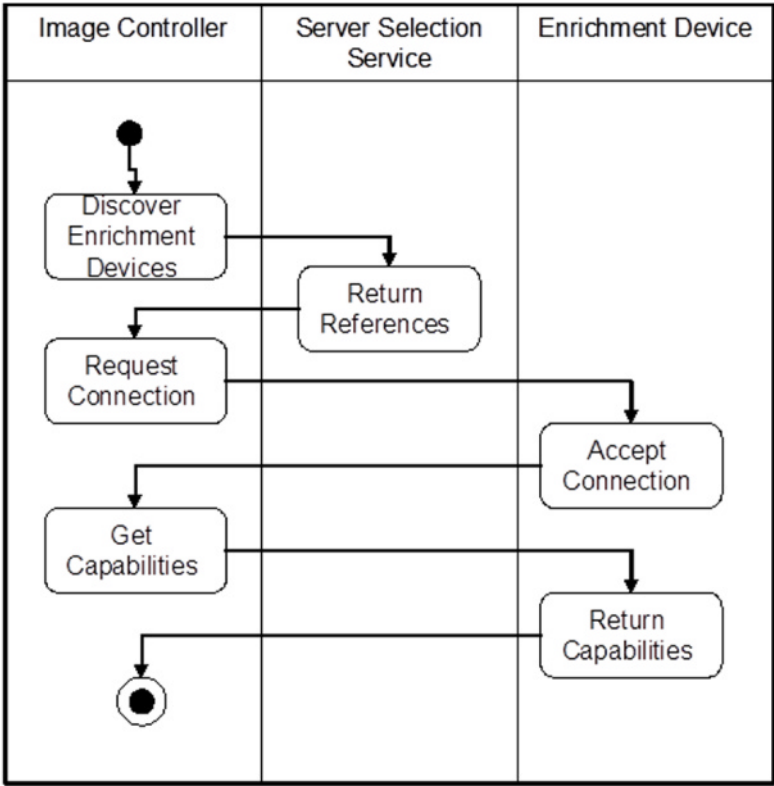


Figure 15 — State diagram Disconnect by IC

- 1) The Image Controller starts the disconnect sequence by terminating the sending of mailpieces to the Enrichment Device and for each open channel, instructing the Enrichment Device to close the channel (see UC101). The closing of a channel only affects the channel between this IC and the Enrichment Device. It does not affect any channels between the Enrichment Device and other Image Controllers.
- 2) The Enrichment Device closes the channels.
- 3) The Image Controller requests a disconnect from the Enrichment Device, which is confirmed by the Enrichment Device if all channels are closed. The confirmation of disconnect is required only for information purposes (e.g. display on HCI of IC).
- 4) The Image Controller is now disconnected from the Enrichment Device.

5.3.1.3.3.2 AF003-01: Permanent Error Occurs during Disconnect

If a permanent error occurs whilst the IC is executing the basic flow, the IC will delete any resources which are required for communicating with the Enrichment Device. The Enrichment Device will receive permanent errors when it attempts to communicate with these resources and will also perform the necessary exception handling.

5.3.1.3.3.3 AF003-02 Disconnect initiated by ED

This Alternative Flow describes how the complete ED disconnects from an Image Controller. This alternative flow may be executed for one; many or all connected Image Controllers.

- 1) The Enrichment Device switches the flow control semaphore on the open channels to “stop” (see UC102). The Image Controller stops sending mailpieces to the Enrichment Device.
- 2) The Enrichment Devices flushes any results which are outstanding. It does not have to process any mailpieces which may be outstanding in internal buffers.
- 3) The Enrichment Device destroys its channel resources. The Image controller channel handlers will receive non-recoverable errors when UC103 – Request Channel Status is executed periodically.
- 4) If the Image Controller requests the status of the Enrichment Device (5.3.1.5, UC006 – Get Enrichment Device Status) whilst the previous steps are being executed, the Enrichment Device will return with the status “terminating” (5.3.1.5, UC006 – Get Enrichment Device Status Step c) 1)).
- 5) Once the channels have been closed, the Enrichment Device responds to any status requests with “Not Ready” (5.3.1.5, UC006 – Get Enrichment Device Status Step c) 1)).

5.3.1.3.3.4 AF003-02a: Permanent Error Occurs during Disconnect

If a permanent error occurs whilst the Enrichment Device is executing the above alternative flow, it will delete any resources which are required for the connection. The Image Controller will receive permanent errors when it attempts to communicate with these resources and will also perform the necessary exception handling.

5.3.1.3.4 Special Requirements

SR ID	Description
SR 0003-01	If the Enrichment Device or Image Controller have any “orphan” channels (channels which are judged to still be open for this Image Controller after the execution of UC101 – Close Channel), then they will be deleted ensuring a graceful exit.
SR 003-02	Before disconnecting, the Image Controller shall stop submitting mail to the Enrichment Device and close all channels.

5.3.1.3.5 Pre-Conditions

Pre ID	Description
PRE003-01	Use case UC002 – Connect has been performed.

5.3.1.3.6 Post-Conditions

Post ID	Description
POST003-01	The Image Controller and the Enrichment Device are no longer connected. All further communication requires that UC002 –Connect be performed

5.3.1.4 UC004 – Open Channel

5.3.1.4.1 Brief Description

When mailpieces are queued within the Image Controller for processing by an Enrichment Device, the Image Controller shall open a channel on a selected Enrichment Device over which the mailpieces will be communicated to the Enrichment Device for processing.

Exactly one channel may be opened per published capability set (see UC002 – Connect). A channel need not be opened for a capability set. A channel shall be opened before it can be used for submitting mailpieces by the Image Controller.

An Image Controller may distribute the images among the Enrichment Devices it is connected to. The load-balancing algorithm as well as the scheduling algorithm (i.e. the order of submitting a mailpiece to the possible Enrichment Devices) is not part of this specification.

5.3.1.4.2 Actors

— Image Controller.

5.3.1.4.3 Flow of Events

5.3.1.4.3.1 Basic Flow

- a) The Image Controller sends a request to an Enrichment Device to open a channel. The open channel request contains the following information:
 - 1) A unique identifier of the Image Controller (see UC002 – Connect)
 - 2) the unique identification of the capability set (one of those previously defined by the Enrichment Device in UC002 - Connect)
 - 3) a reference of the Image Controller channel which the Enrichment Device can use to communicate when exchanging data via this channel. This is required when executing the use case UC102 – Control Flow
- b) The ED acknowledges the opening of the channel, thereby confirming the mailpiece processing can start. Following information about the channel is sent by the Enrichment Device when it confirms that the channel has been opened:
 - 1) The reference of the Enrichment Device channel.
 - 2) The same information as returned by UC103 – Request Channel Status (Basic Flow)

5.3.1.4.3.2 AF004-01: Enrichment Device rejects open channel request

As for Basic Flow except: The Enrichment Device responds negatively to the Open Channel request from the Image Controller (Step a) above). The negative response contains a text description in English (see SUP003) of the reason why the request has been rejected.

The Image Controller may re-attempt to open same channel no sooner than the time defined in the supplementary requirement Open_Channel_Retry_Delay, after receiving this response.

5.3.1.4.3.3 AF004-02: Permanent Error Occurs

If a permanent error occurs whilst the use case is being executed, the Image controller may continue using any open channels and the complete Enrichment Device. The component which received the permanent error will destroy any resources which were being used to open the channel. The Image Controller may re-attempt to open the channel at its own discretion.

5.3.1.4.3.4 AF004-03: Capability Set does not match available Capability Set

If the capability set in the Open Channel request does not match the sets which were defined in the UC001 – Connect, the Enrichment device will reject the open channel request as defined in AF004-01: Enrichment Device rejects open channel request

5.3.1.4.4 Special Requirements

SR ID	Description
SR 004-01	Submitting mailpieces may only start if the Enrichment Device has indicated it has capacity either in the return of Open Channel or through the execution of UC102 – Control Flow
SR 004-02	If the IC needs to open more than one channel, it can initiate all requests in parallel (no need to wait for the acknowledge of a channel to send the OpenChannel for another channel)

5.3.1.4.5 Pre-Conditions

Pre ID	Description
PRE004-01	The Image Controller and Enrichment Device are connected successfully (UC002 – Connect)

5.3.1.4.6 Post-Conditions

Post ID	Description
POST004-01	A channel has been opened between an Image Controller and an Enrichment Device. Submitting mailpieces may only start if the Enrichment Device has indicated it has capacity either in the return of Open Channel or through the execution of 5.3.1.8, UC103 – Request Channel Status.

5.3.1.5 UC006 – Get Enrichment Device Status

5.3.1.5.1 Brief Description

This use case is executed by the Image Controller for two reasons:

- Mandatory: to ensure periodically that there is a connection between the Image Controller and the Enrichment Device. If the connection appears to not be working correctly, remedial action is taken. This is described in the alternative flows of this use case.
- Optional: If required, to display the status of the Enrichment Device to a human actor, or to use this information within the processing algorithms of the Image Controller.

5.3.1.5.2 Actors

- Image Controller.

5.3.1.5.3 Flow of Events

5.3.1.5.3.1 Basic Flow

- a) Use case UC002 – Connect has been executed.
- b) Periodically, as defined by the supplementary requirement Get_ED_Status_Period, the Image Controller requests the status of the complete Enrichment Device from each connected Enrichment Device.
- c) The Enrichment device returns its status which is one of:
 - 1) Ready;
 - 2) Not ready;

3) Terminating.

d) Included in the return information is also a free text message which describes more explicitly the current state of the Enrichment Device.

5.3.1.5.3.2 AF006-01: Permanent Error Occurs

If a permanent error occurs whilst the use case is being executed, the Image controller will execute UC003 – Disconnect and subsequently UC002 – Connect.

5.3.1.5.3.3 AF006-02: Enrichment Device uses Execution to Check Usage

The Enrichment Device is aware of the execution of this use case. It uses this knowledge as a “ping” or “check alive” to ensure that it is still being used by the Image Controller. Any handling which is required should the Enrichment Device determine that it is not being used is implementation specific and is not defined any further within this document.

5.3.1.5.4 Special Requirements

SR ID	Description
SR 006-01	

5.3.1.5.5 Pre-Conditions

Pre ID	Description
PRE006-01	UC002 – Connect has been executed successfully

5.3.1.5.6 Post-Conditions

Post ID	Description
POST006-01	The Image Controller has received the status of the Enrichment Device.

5.3.1.6 UC101 – Close Channel

5.3.1.6.1 Brief Description

The Image Controller executes this use case in order to close a previously opened channel (see UC004 – Open Channel). This use case is typically executed as part of UC003 – Disconnect.

Any outstanding mailpieces will be discarded by the Enrichment Device. Therefore, the Image Controller should ensure that no mailpieces are outstanding before closing the channel.

5.3.1.6.2 Actors

- UC003 – Disconnect;
- Image Controller.

5.3.1.6.3 Flow of Events

5.3.1.6.3.1 Basic Flow

The basic flow (Figure 16) describes the closing of a channel and the discarding of outstanding mailpieces.

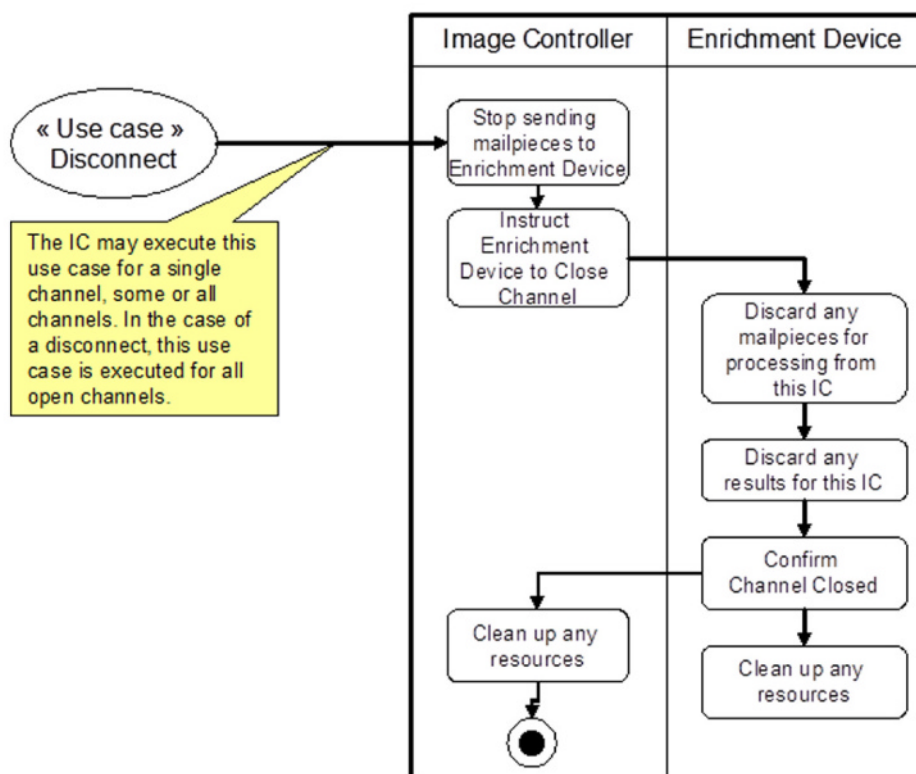


Figure 16 — Close channel basic flow

The steps for closing the channel are:

- 1) The Image Controller stops submitting mailpieces (see UC104 – Submit Mailpiece) to the Enrichment Device for processing. The resources for receiving results (see UC105 – Transmit Result) remain active.
- 2) The Image Controller instructs the Enrichment Device to close the channel. The close channel request contains the instruction to discard any pending mailpieces and any results which have not been sent.
- 3) The Enrichment Device discards all pending mailpieces for this Image Controller and channel. Any results which have not been sent are discarded.
- 4) The Enrichment Device confirms the closure of the channel. After the confirmation, the Enrichment Device removes any resources which belong to this channel.
- 5) The Image Controller removes any resources which belong to this channel.

5.3.1.6.3.2 AF101-01: Close Channel Request generates error

If an error occurs when the Image Controller executes this use case, the Image Controller executes UC003 – Disconnect and subsequently UC002 – Connect (if required).

If this use case is being executed as part of UC003 – Disconnect, then the channel will be assumed to be closed.

5.3.1.6.3.3 AF101-02: Enrichment Device doesn't respond to Close Channel Request

If the Enrichment Device does not respond to the close channel request within Close_Channel_TimeOut_Delay, when the Image Controller executes this use case, the Image Controller executes UC003 – Disconnect and subsequently UC002 – Connect (if required).

If this use case is being executed as part of UC003 – Disconnect, then the channel will be assumed to be closed.

5.3.1.6.3.4 AF101-03: Enrichment Device Closes channel

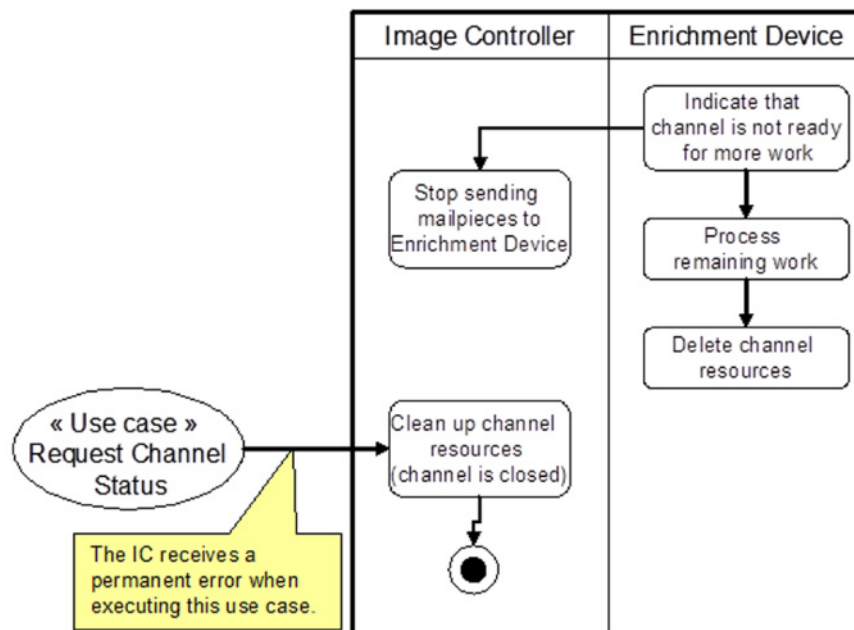


Figure 17 — State diagram ED closes channel

The Enrichment Device closes the channel by destroying the resources associated with that channel. Prior to destroying the resources, the Enrichment Device indicates that the channel is no longer ready to accept more work (see UC102 – Control Flow), and completes any outstanding mailpieces.

The Image Controller discovers that the channel is no longer available when it executes the use case UC103 – Request Channel Status and performs remedial action.

5.3.1.6.4 Special Requirements

SR ID	Description
SR 101-01	Before closing a channel the ED shall stop the IC submitting mailpieces (indicate saturation).

5.3.1.6.5 Pre-Conditions

Pre ID	Description
PRE101-01	UC004 – Open Channel has been previously executed.

5.3.1.6.6 Post-Conditions

Post ID	Description
POST101-01	Any references which were used by the Image Controller or Enrichment Device to communicate via the channel are no longer valid.
POST101-02	The Enrichment Device has no pending mailpieces or outstanding results for this channel.

5.3.1.7 UC102 – Control Flow

5.3.1.7.1 Brief Description

The flow of mailpieces from the Image Controller to the Enrichment Device is controlled by the Enrichment Device using a semaphore model. This semaphore model indicates to the Image Controller whether the Enrichment Device is:

— Not ready to accept more work:

The processing capacity for a channel is exhausted and no more mailpieces may be submitted for processing.

— Ready to accept more work:

There is processing capacity for the channel and the Image Controller may submit mailpieces for processing.

In order to optimize performance, the Enrichment Device may allow a limited but variable number of pending transactions for each Image Controller. For example: an Enrichment Device may allocate the maximum number of pending transactions to a single Image controller when only one is connected, but may need to dynamically modify this allocation when a second Image Controller connects, to share the capacity amongst the Image Controllers. This pending transaction allocation will be included when this use case is executed.

The Enrichment Device may allow for some mailpieces being submitted after it has indicated that it is no longer to receive more work. If a mailpiece is not accepted by the Enrichment Device, this will be indicated (see UC104 – Submit Mailpiece).

Subclause 5.2.3.11, Flow Control Model, describes how the flow control is intended to be used. It is envisaged that the Enrichment Device will implement thresholds to prevent the state switching rapidly and to enable an optimal utilization of the interface.

5.3.1.7.2 Actors

- State Manager.
- Image Controller.

5.3.1.7.3 Flow of Events

5.3.1.7.3.1 Basic Flow

The basic flow describes the indication of "Not ready for more work".

- The Enrichment Device wishes to indicate that the processing capacity for a channel is exhausted.
- The Enrichment Device informs the Image Controller that the channel is exhausted. The information contains:

- 1) Not ready to receive more work indication:

This flag indicates exclusively the ability of the Enrichment Device to accept/not-accept more work from the Image Controller. The Image controller shall stop submitting mailpieces when the Enrichment Device indicates that it is not ready to accept work. Any mailpieces which are submitted after the enrichment Device has indicated that it is not ready, may be rejected by the Enrichment Device. The exception handling in this case is the responsibility of the Image Controller.

- 2) The number of pending mailpieces which are buffered in the Enrichment Device for which no result has been generated and transmitted (see UC105 – Transmit Result).
 - 3) The maximum number of mailpieces which may be submitted by the Image Controller over this channel before the Enrichment Device indicates that no more work may be accepted. This value may be used by the Image Controller to enhance the optimal utilization of the channel. However, if the Enrichment Device indicates (item a.) that it will not accept more work, even when the number of pending is not the same as the maximum, the Image Controller should stop submitting mailpieces. The Enrichment device can indicate that this value is not set by the Enrichment Device and does not contain useful information.
- c) The Image Controller acknowledges that the indication has been received.
 - d) The Image Controller stops submitting any new mailpieces to the Enrichment Device over the channel which is not ready to receive more work.
 - e) The Image Controller continues to receive results which are transmitted from the Enrichment Device.

5.3.1.7.3.2 AF102-01: No capacity for Submitted Mailpiece after Not ready indication

If the Image Controller sends too many mailpieces for the Enrichment Device to handle, after the Enrichment Devices has indicated that the channel is no longer ready to accept more work, the Enrichment Device will:

- a) Respond to the submission with an indication indicating whether the mailpiece was accepted or discarded (see UC104 – Submit Mailpiece).

5.3.1.7.3.3 AF102-03: Enrichment Device indicates channel is ready to receive more work.

- 1) The Enrichment Device wishes to indicate that the processing capacity for a channel is available.
- 2) The Enrichment Device informs the Image Controller that the channel is now ready to receive more work. The information is the same as in the Basic Flow (Step b)). *except for which Step b) 1) which shall read "Ready to receive work".*
- 3) The Image Controller acknowledges that the indication has been received.
- 4) The Image Controller may start submitting any mailpieces to the Enrichment Device over the channel.

5.3.1.7.3.4 AF102-04: Permanent Error Occurs

If a permanent error occurs whilst indicating a saturation state change, the Enrichment Device will at least close the channel and may disconnect from the Image Controller.

5.3.1.7.4 Special Requirements

SR ID	Description
SR 102-01	The flow control is done exclusively with "Put Channel State" transactions and not using the return values from Submit Mailpiece because the order in which the return values may be

SR ID	Description
	received by the IC is not guaranteed and could result in deadlock.
SR 102-02	The ED may not indicate a change in the state before the IC has acknowledged the previous change. This is to prevent deadlock.

5.3.1.7.5 Pre-Conditions

Pre ID	Description
PRE102-01	UC004 – Open Channel has been executed.

5.3.1.7.6 Post-Conditions

Post ID	Description
POST102-01	The Image Controller has been informed of the channel saturation state.

5.3.1.8 UC103 – Request Channel Status

5.3.1.8.1 Brief Description

Any time when the Image Controller needs to know the status of a channel, it executes the use case. This may be:

- Periodically any time after executing UC004 – Open Channel.

5.3.1.8.2 Actors

- UC004 – Open Channel.
- Image Controller.

5.3.1.8.3 Flow of Events

5.3.1.8.3.1 Basic flow

The steps for Request Channel Status are:

- 1) The Image Controller requests the channel status from the Enrichment Device, using the reference for the channel which was passed in UC004 – Open Channel.
- 2) The Enrichment Device responds within the time defined in the supplementary requirement `Request_Channel_Status_Reply_Delay` with the Channel status. This contains the information described in UC102 – Control Flow Basic Flow, Step b).

NOTE The return value to this request is not the status which has been requested. Instead it is an indication that the request has been received. This is requested for the status and the Enrichment Device will “push” the status to the Image Controller. This method has been selected to avoid deadlock.

The sequence diagram (Figure 18) shows how requesting of the status should be implemented. This diagram is for explanatory purposes only and is defined in detail in Clause 7.

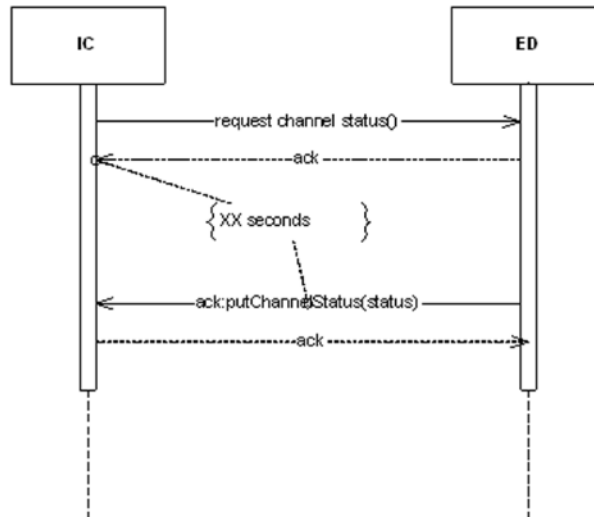


Figure 18 — Request channel status flow

5.3.1.8.3.2 AF103-01: Permanent Error Occurs

If a permanent error occurs, the Image Controller will destroy the channel.

5.3.1.8.4 Special Requirements

SR ID	Description
SR 103-01	This use case returns "immediately", and causes the Enrichment Device send the channel status information as defined in UC102 – Control Flow. This approach has been selected (as opposed to returning the channel status as the return value), because of the risk of deadlock occurring when "Put Channel Status" (see 5.3.1.7, UC102 – Control Flow) is triggered by the Enrichment Device at the same time
SR 103-02	If the channel status isn't received within the time defined by the supplementary requirement Request_Status_Time, this is judged to be a permanent error. The Image Controller may re-create the channel.
SR 103-03	There is a minimum period of time between two executions of this use case, which is defined in the supplementary requirement Request_Channel_Status_Repeat_Delay

5.3.1.8.5 Pre-Conditions

Pre ID	Description
PRE103-01	Use Case UC004 – Open Channel has been executed

5.3.1.8.6 Post-Conditions

Post ID	Description
POST103-01	The Image Controller has received the channel status for a single channel from the Enrichment Device.

5.3.1.9 UC104 - Submit Mailpiece

5.3.1.9.1 Brief Description

The Image Controller executes this use case when it requires a mailpiece to be enriched by an Enrichment Device. A mailpiece is submitted over an opened channel (see UC004 – Open Channel).

A mailpiece may be submitted to multiple Enrichment Devices and also multiple channels on the same Enrichment Device. The rules governing to which Enrichment Device or channel a mailpiece is submitted are not part of this interface. However, each submission shall contain a unique submission ID.

For every submission, the Enrichment Device will execute the use case UC105 – Transmit Result once. The order of the results need not correspond to the order of submission.

5.3.1.9.2 Flow of Events

5.3.1.9.2.1 Basic Flow

The steps for Submit Mailpiece are:

- a) The Image Controller submits a mailpiece over a channel for enrichment. The submission shall contain the following information:
 - 1) Submission Identification: information which uniquely identifies the submission of the mailpiece. The submission ID shall be unique for each submission within a channel and may not be repeated within the period defined by the supplementary requirement SubID_LifeTime.
 - 2) Enrichment Time: the time in milli-seconds within which the Enrichment Device has to generate a result. This is a relative time. The time is relative to the time at which the Enrichment Device indicates that the Submission has been accepted..
 - 3) Requested Capabilities: these are defined in 6 and are a subset of the capability set defined for this channel.
 - 4) Pre-knowledge: the mailpiece pre-knowledge is defined in 6.
- b) The submission may optionally contain:
 - 1) Image Data: the image data and format is defined in 6.
- c) The Enrichment Device indicates to the Image Controller that the mailpiece has been accepted.
- d) The Enrichment Device executes UC105 – Transmit Result once for the submission within the Enrichment Time.

5.3.1.9.2.2 AF104-01: Enrichment Device Rejects Mailpiece

The Enrichment Device may reject the mailpiece which has been submitted, if for example, the requested capabilities do not match those which were defined for the channel, or the Enrichment Device has previously indicated that it is no longer ready to receive any more work (see UC102 – Control Flow).

The Enrichment Device will indicate that the mailpiece is rejected in the return code to the submission (not accepted). The Image Controller may take any remedial action. This is implementation specific and is not defined any further in this document.

5.3.1.9.2.3 AF104-02: Submission Generates Permanent Error

If the submission of a mailpiece generates a permanent error, the Image Controller will execute UC101 – Close Channel.

5.3.1.9.2.4 AF104-03: No Result Returned

If the Enrichment Device does not return a result within the Enrichment Time, the Image Controller may take remedial action. This action is implementation specific and is not defined in further detail in this document.

5.3.1.9.2.5 AF104-04: Result returned after Enrichment Time

If the Enrichment Device returns a result after the Enrichment Time, the Image Controller may utilize this result. The exact handling is implementation specific and is not defined in further detail in this document.

5.3.1.9.3 Special Requirements

SR ID	Description
SR 104-01	Results need not be returned in the order in which the mailpieces were submitted
SR 104-02	A result will always be returned for a submission within the Enrichment Time. If the mailpiece cannot be processed by the Enrichment Device, a result will be returned which indicates this.
SR 104-03	Only one result will be returned for a submission
SR 104-04	The Enrichment Time starts when the Enrichment Device indicates to the Image Controller that it has received the submission request. E.g. it returns from the called method.
SR 104-05	The Submission ID alone uniquely identifies the transaction over this channel. It is not a combination of mailpiece id and submission id. Therefore the mailpiece ID is not required as a parameter of the method and will be only included in the XML pre-know data.

5.3.1.9.4 Pre-Conditions

Pre ID	Description
PRE104-01	Use case UC004 – Open Channel has been executed and the Enrichment Device has indicated that the channel is not saturated (UC102 – Control Flow AF102-03)

5.3.1.9.5 Post-Conditions

Post ID	Description
POST104-01	A mailpiece has been submitted to the Enrichment Device over a channel.

5.3.1.10 UC105 – Transmit Result

5.3.1.10.1 Brief Description

This use case is executed when the Enrichment Device has either completed processing a previously submitted mailpiece, or the Enrichment Time has expired for a previously submitted mailpiece (see UC104 – Submit Mailpiece).

The Enrichment Device sends one (and only one) result to the Image Controller for a submitted mailpiece. This result terminates the transaction for the mailpiece between Image Controller and Enrichment Device. Results may be transmitted out of sequence.

5.3.1.10.2 Actors

— Image Controller.

5.3.1.10.3 Flow of Events

5.3.1.10.3.1 Basic Flow

The basic flow describes the flow of events when the enrichment of a mailpiece was completed within the Enrichment Time:

- a) The Enrichment Device has completed processing on a mailpiece which was previously submitted by the Image Controller.
- b) The Enrichment Time which was defined in UC104 – Submit Mailpiece has not expired.
- c) The Enrichment Device transmits the result to the Image Controller. The result contains the following information:
 - 1) Submission Identification: information which uniquely identifies the submission of the mailpiece. If a mailpiece is submitted multiple times (concurrently or sequentially), the combination of the Mailpiece Identification and Submission Identification identifies this mailpiece uniquely.
 - 2) Result Information: this is defined in 6.
- d) The Image Controller indicates that the result has been received.
- e) The Enrichment Device need not store any information for this mailpiece.

5.3.1.10.3.2 AF105-01: Enrichment not completed within Enrichment Time

If the Enrichment Device does not complete enrichment of the mailpiece within the Enrichment Time, it will return a result before the expiration of the Enrichment Time which indicates that the enrichment has timed out. Any partial result information will be returned before the expiration of the Enrichment Time. For example, if an outward result is available but the inward result is not available, the outward information will be returned.

5.3.1.10.3.3 AF105-02: Image Controller indicates Result not received successfully.

If the Image Controller indicates (as a return value from the transmission of the result), that the result was not received successfully, the Enrichment Device will discard the result and consider it to have been sent.

5.3.1.10.3.4 AF105-03: Transmitting Result causes Permanent Error

If the transmission of a result causes a permanent error, the Enrichment Device will destroy the channel (see AF101-03: Enrichment Device Closes channel).

5.3.1.10.4 Special Requirements

SR ID	Description
SR 105-01	The Submission ID alone uniquely identifies the transaction over this channel. It is not a combination of mailpiece id and submission id. Therefore the mailpiece ID is not required as a parameter of the method and will be only included in the XML pre-know data.
SR 105-02	If the mailpiece could not be processed because of inconsistencies in the data of the submission (e.g. incompatible capabilities, corrupt image format), the result which is returned will indicate these problems.

5.3.1.10.5 Pre-Conditions

Pre ID	Description
PRE105-01	UC104 – Submit Mailpiece has been previously executed
PRE105-02	The Enrichment Time has not expired.

5.3.1.10.6 Post-Conditions

Post ID	Description
POST105-01	A result has been submitted to the Image Controller.

5.3.2 Supplementary Requirements

SUP ID	Description
SUP001	This description is limited to Enrichment Devices and Image Controllers which are connected using a Local Area Network (LAN)
SUP002	This description is limited to “real-time” processing.
SUP003	All natural language text descriptions included in interactions between an Image Controller and Enrichment Device will be in English.
Publish_Retry_Delay	15 s
Connect_Retry_Delay	15 s
Open_Channel_Retry_Delay	15 s
Close_Channel_TimeOut_Delay	15 s
Get_ED_Status_Period	15 s
Disconnect_TimeOut_Delay	15 s
Request_Channel_Status_Repeat_Delay	15 s
Request_Channel_Status_Reply_Delay	15 s
SubID_LifeTime	31 d (1 d = 24 h)

The delays indicated above are default values unless explicitly specified for a project.

5.3.3 Rejections

5.3.3.1 General

During definition and review of the use cases some of them were discarded. For information they are listed in this clause.

5.3.3.2 Discarded Use Cases

Use Case	ID	Description
Get Configuration Data	Discard	Configuration data (e.g. Batch) is included with each mailpiece or in the channel definition.
Get/Push Queue Status	Discard	Included in Put Enrichment Device status.
Publish Configuration Data	Discard	Configuration data (e.g. Batch) is included with each mailpiece or in the channel definition.

Use Case	ID	Description
Put Batch Parameters	Discard	Configuration data (e.g. Batch) is included with each mailpiece or in the channel definition.
Request Capabilities	Discard	
Terminate Enrichment	Discard	Covered in Close Channel.
Request Mailpiece	Discard	Choice of semaphore model
GetImageControllerstatus	Discard	Choice of Image Controller as client in the model
Put Channel Status	Discarded	This is a message used in the Use case "Control Flow" and not a use case in its own right.
Get Capabilities	Discarded	This is an action in the use case "Connect" and not a use case in its own right.
UC005 Get Enrichment Device Status	Discarded	This use case describes a message and not a use case. Remove this UC because the aims of the message can be covered by a) ED disconnects from IC is covered in UC - Disconnect. B) The need for the ED to know if the IC is present, can be fulfilled by checking if "Get ED Status" is executed or by observing its channels

6 Interface Design Description IDD

NOTE The **Interface Definition Description** (IDD) defines the data model for the CEN OCR/VCS Standard Interface.

6.1 Purpose

This clause provides XML schemas that define the data model used for the definition of an interface in the postal coding environment. The focus of this model is thereby on the interface between an IC (Image Controller) and an enrichment device. An enrichment device can be represented by an automatic address reader (OCR), a video coding system (VCS) or a voter. All device types can exist in an overall system in any number of instances, possibly from different vendors with its specific properties.

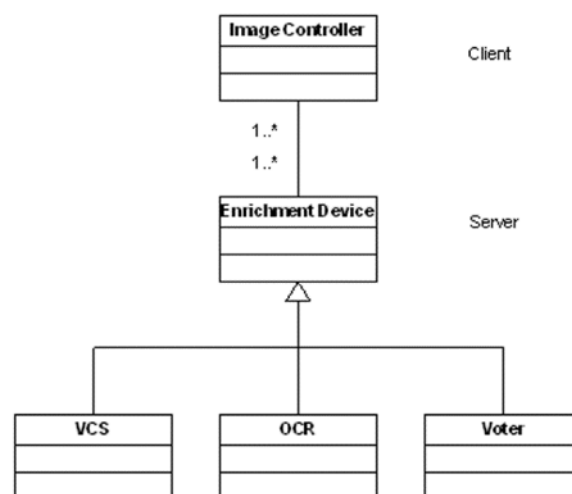


Figure 19 — System Overview

The communication between the IC (Image Controller) and the ED (Enrichment Device) is done by means of a functional middleware layer - e.g. CORBA, a simple socket connection. The functional layer uses XML documents for exchange of data which is required to process a mailpiece (e.g. pre-knowledge, result). Thereby XML schemas are used to specify the data structures and its contents.

An XML schema is a formalization of specific constraints, expressed as rules or a model of structure that applies to a (class of) XML documents. This applies as mentioned above to the static structure of a data type as well as to the content of single elements.

XML schemas provide a wide range of features to specify data structures. They can be used to validate XML instance documents. This is the most common use and generally the initial purpose of schemas.

6.2 Scope of IDD

This clause specifies the “mailpiece” related data only and does not cover the “infrastructure” data. These terms are defined as:

- **Mailpiece Data:** the information which describes attributes of the physical mailpiece which is used to aid and is a product of enrichment, as well as identification references which an Image Controller and Enrichment Device require in order to identify a specific mailpiece. For example: mailpiece width & height, indicia information, address location, city name, sort code, Letter ID, Submission ID etc. This information is defined in Section B of this document.
- **Infrastructure Data:** the basic information, such as identification references which an Image Controller and Enrichment Device require in order to communicate effectively. For example: in CORBA, object references (IOR). This information is defined in Clause 7.

This document defines the syntax and partly the semantics of the Mailpiece data. Using the definition contained herein, it is possible to create an interface which will enable the correct interaction between an Image Controller and an Enrichment Device, but will not be fully checked for semantic correctness (e.g. is the postcode 4 or 5 digits). The most relevant semantic definitions of the interface are customer specific and outside the scope of the standard.

The intended audience is any manufacturer of an Image Controller or Enrichment Device who implements the CEN standard OCR/VCS interface.

6.3 Prerequisites

The fundamental prerequisite is knowledge about XML and XML schemas. It is definitely necessary to understand the data model. Refer to the [XML Schema] and [ProXML] in the reference list to understand, modify or create XML schemas.

Refer to 5.2 and 5.3 to get information about the Use Cases and Requirements, which affects the Domain Data Model and its specifications.

Refer to Clause 7 to get information about the class model and the dynamic behavior of a CORBA or TCP/IP implementation.

6.4 Overview

The subclause is organized into the following main sections:

- Section A – TIFF Definition;
- Section B – Mailpiece and Capability Data Definition:
 - 1) Defines the requirements for the data model (refer to 6.6.1);

- 2) The Domain Object Model (refer to 6.6.2);
- 3) Domain Data model & types (refer to 6.6.3).

6.5 Section A – TIFF Definition

6.5.1 Tiff Usage

6.5.1.1 General

All images are represented using the TIFF file format compliant with the TIFF Revision 6.0 (June 3rd 1992) Baseline specification, refer to [TIFF]. The Baseline specification has been enhanced with the specification [TIFF_TN2] as problems have been encountered with the embedding of JPEG compressed images.

The TIFF tags are organized in three parts: the Baseline TIFF, the TIFF Extensions and the Private fields and values:

- Baseline TIFF is the core of TIFF, the essentials that all mainstream TIFF developers should support in their products.
- Tiff Extensions are TIFF features that may not be supported by all TIFF readers. TIFF creators who use these features will have to work closely with TIFF readers in their part of the industry to ensure successful interchange.
- Private Fields and Values are user definable fields with associated values. These tags are numbered 32768 or higher.

In the scope of the CEN OCR/VCS Standard Interface, the TIFF tags are classified into 3 categories:

- M : Mandatory, the tag is required in the header
- O : Option, the tag may be included in the header for optional implementation
- I : Ignored, the tag should be ignored

All Private Fields and Values should be ignored.

Each TIFF tag has been assigned to a category in order to match the following principles:

- Multiple images may be contained within one single TIFF file. There may be many Image File Directories (IFD).
- All orientations may be used.
- The supported image types are Bilevel (binary), Grayscale, RGB Full Color and optionally YCbCr FullColor. The following types are not supported: CYMK, Halftoned, ColorMap.
- The bi-level image data contained within the TIFF file may be compressed using the following techniques:
 - 1) CCITT G3 1D Modified Huffman Run Length encoding.
 - 2) T4-encoding: CCITT T.4 bi-level encoding as specified in Section 4, Coding, of CCITT Recommendation T.4 “Standardization of Group 3 Facsimile apparatus for document transmission.” International Telephone and Telegraph Consultative Committee (CCITT, Geneva: 1998).