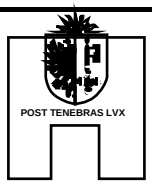

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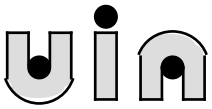

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PAPYRUS 3.1

The DICOM compatible image file format

Status : **Working Draft 0.1 - February 1996**

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PAPYRUS 3.1
The DICOM-compatible Image File Format

0.Foreword

This document contains a proposal for the extension of the *PAPYRUS* file format. It takes into consideration the new *DICOM Standard* which addresses the open interchange of medical images in files or on removable storage media. Comments and suggestions are welcome and should be addressed to the Digital Imaging Unit at the University Hospital of Geneva.

1.Rationale

The first version of *PAPYRUS* file format was created in 1990 based on the data dictionary and data structure of the ACR/NEMA 2.0 communication standard. This file format responded to a need for an image storage and communication format. Such a format should remain independent from any communication method used to transfer the images or any database structure used to handle these images. The PAPYRUS format was further extended and adopted by several European projects on digital imaging and teleradiology. The University Hospital of Geneva also provides a complete source code library called the "PAPYRUS toolkit" for easily reading and writing PAPYRUS files.

In 1992 the ACR/NEMA committee has issued some "pre-final" drafts of the completely remodeled *DICOM standard.* All along the development of this new standard we have been in close contact with members of the ACR-NEMA and it has always been our goal to update the PAPYRUS file format to match the new *DICOM* data structure.

The current standardization of *DICOM V 3.0* has focused on the communication of digital image data across an on-line point-to-point or network interface. Beyond this prime focus, it is now clear that the on-line communication interoperability achieved by *DICOM 3.0* needs to also be specified to include the "Storage Media Data Interchange" for off-line exchanges of image data.

Recently we have worked closely with members of ACR-NEMA- WGVI on the concept of a *DICOM* compatible file format. Two documents were issued (White papers of October 1st 1992 and December 1st 1992) describing the needs for a file format and the possible solution that could be envisioned. In a first meeting with WG-VI during SPIE conference in February 1992 first proposal for a *DICOM* file format was discussed.
Early in 1993 WG V of ACR-NEMA endorsed the main concepts suggested in this white paper and an additional part 10 of the *DICOM Standard* was drafted. It is expected that by mid 1993 this part 10 will have reached stability to provide an adequate foundation for Media Storage File Format standardisation.

2. File format solutions

Several file formats were proposed in the white papers issued by the ACR/NEMA in October 1992. A general organization of the *DICOM* Image File Format was suggested. It assumes that the Media Layer offers the *Basic DICOM File Services.*

In the proposed solution one and only one Data set associated with any *DICOM Information Object* (which is suited for storage) should be stored in each file of the *Basic DICOM File Service*. Its general structure was presented as follows:

1) If the Information Object is a single Image Information Object, each file will contain a single image.
2) If the Information Object is a Multiple Image Object (e.g. an Image Series Folder), such files will contain multiple images (a series in this example).
3) If an "Object Directory" is desired, then a Directory Information Object (a folder of references) shall be defined and may be included in the "Master Media Directory File". Each formatted media shall contain at most one Master Media Directory File. The Master Media Directory File may contain no Directory Information. It seems a good objective that at least a simple Patient/Study Level Directory be standardized to maximize interoperability.

It was recommended that each File containing a stored Information Object should contain a File Header with "Meta Information" such as: Transfer Syntax UID used for the encoding of the Information Object Data, SOP Class UID (Information Object Definition identification), SOP Instance UID (Information Object Instance contained into the remainder of the file). It is recommended that this information which is the equivalent of "Command Set" or Group 0 data, be redefined as a set of Group 2 data elements as "File Meta Information". It would be possible to reuse the Group 0 data elements, but it may result in some confusion as some data elements are missing such as Transfer Syntax. Their values in the stored files may also differ, because of translations, from the information received over the network in Group 0 data elements.

The Meta Information Header, will be followed by a single *DICOM Data Set* (group 8 and upwards) as driven by the Information Object Definition. The structure and encoding of this Data set shall follow the *DICOM V3.0* specifications of Parts 3 (Information objects), 5 (Data Structure & Semantics) & 6 (Data Dictionary).

It would be nice to use as the name of each file, the SOP Instance UID associated with the Object Instance stored. However, if a 64 character maximum length is seen as a very strict constraint on the Media Format basic file naming service (DOS is limited to 8 characters !), arbitrary file names may be acceptable if the "Directory Information Objects", include with each referenced UID the associated "file name".
These concepts are now fully addressed by *DICOM Part 10* which will form the foundation for *PAPYRUS V. 3.0*.

In a second document issued in December 1992 (Additions to the white paper), three file "packaging" alternatives were further described and extensively discussed. The three alternatives were:

#1- A file contains a study folder (by value)

#2- A file contains an image folder (i.e. PAPYRUS v.2.0 with internal references)

#3- A file contains a study descriptor associated with multiple single image files (i.e. PAPYRUS v.2.0 with external references)

3. The PAPYRUS file format

To define the *Papyrus file format*, we adopt the *Media Storage Model* defined in the Draft of *DICOM Part 10* , in order to be compatible with the *DICOM Standard.*
On the basis of this Model, we defined two *Media Storage Application Profiles* :

PAPYRUS-FILE : Encapsulation of the Images of a same Series in a single Object called a *PAPYRUS-File Object* which is stored in a file. This file is called a *PAPYRUS-File.*
and

PAPYRUS-FOLDER : Consist of a File Folder to reference separate files.
These files each contain :
- The information related to a *DICOM Patient, Visit* or *Study Object.*
or
- a *PAPYRUS-File Object* encapsulating one or more images of the same Series.

(Two different Series may be encapsulated respectively in two different Objects storted in different files, a *PAPYRUS-Folder Object* -stored in a *PAPYRUS Folder*- referencing these files).

This document uses concepts such as ***IOD***, ***SOP Class***, ***UID*** which are defined in *DICOM V.3.0* Part 3,4 and 5.

A short abstract of these concepts is made in Annexe A.

3.1 PAPYRUS-File : The Images Encapsulation File

The purpose of this profile is to group several images belonging to a same Series in a single file.

This structure is designed for the Media Storage.

Characteristics :

- In this profile, any *Image Information Object* may be encapsulated.
- Corresponding *DICOM Standard SOP Classes* are listed in Annexe C.
- This *Profile* does not specify the Media Format, nor the Physical Media.

Note : The interoperability with *PAPYRUS-File* between systems requires local agreement between communication systems (e.g. Media Format, Physical Media used).

3.2 PAPYRUS-Folder : The Image File Reference Folder

Warning :The structure of Folder is bound to change because this concept is under development in DICOM Part 10 (Concept of DICOMDIR).

This profile is defined in order to link together several *PAPYRUS-Files* defined as above. The purpose is to group different Series of different Studies.
The *Patient IOD*, the *Visit IOD* and the *Study IOD* may be stored in separate Files and are referenced by external pointers.

Each Series and each Study must belong to the same patient.

The different *PAPYRUS-Files* that are referenced contain one or several images belonging to a same Series. These files are referenced by a “Parent file” which permits to select and locate them.

All images referenced by a given folder must come from the same patient.

Characteristics:

- In this Profile, *Image Information Object* instances belonging to a Series can be regrouped in Series in the same *PAPYRUS-File*. This characteristic is not mandatory.

- The different files referenced by a same folder must be physically located on the same media.

- This Profile does not specify the Media Format, nor the Physical Media.

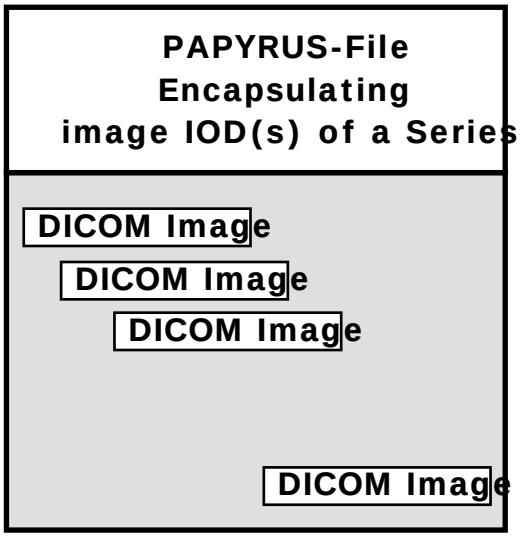
Note : The interoperability with *PAPYRUS Folder* between systems requires local agreement between communication systems (e.g. Media Format, Physical Media used).

3.3. Application of these profiles

3.3.1. First application

The first and most obvious application of *PAPYRUS* files is to store different images belonging to a same Series in a single *PAPYRUS File*.

Example 1

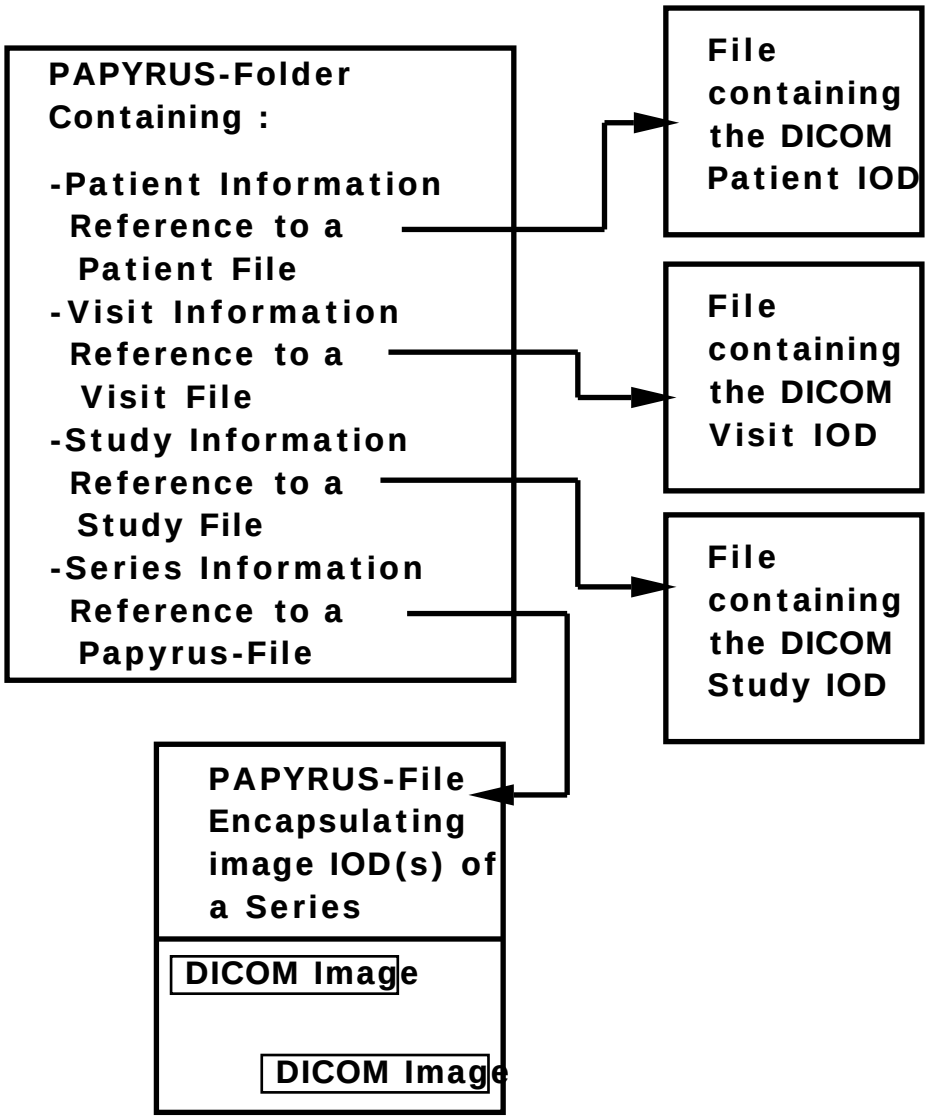


3.3.2. Second application

The *PAPYRUS File* defined in 3.3.1. may be referenced by a *PAPYRUS-Folder Object* stored in a *PAPYRUS Folder* which can reference three other files too.

These three files shall contain respectively the *Patient IOD*, the *Visit IOD* and the *Study IOD.*
The purpose is to provide an access to all relevant information about these image associated objects.

Example 2



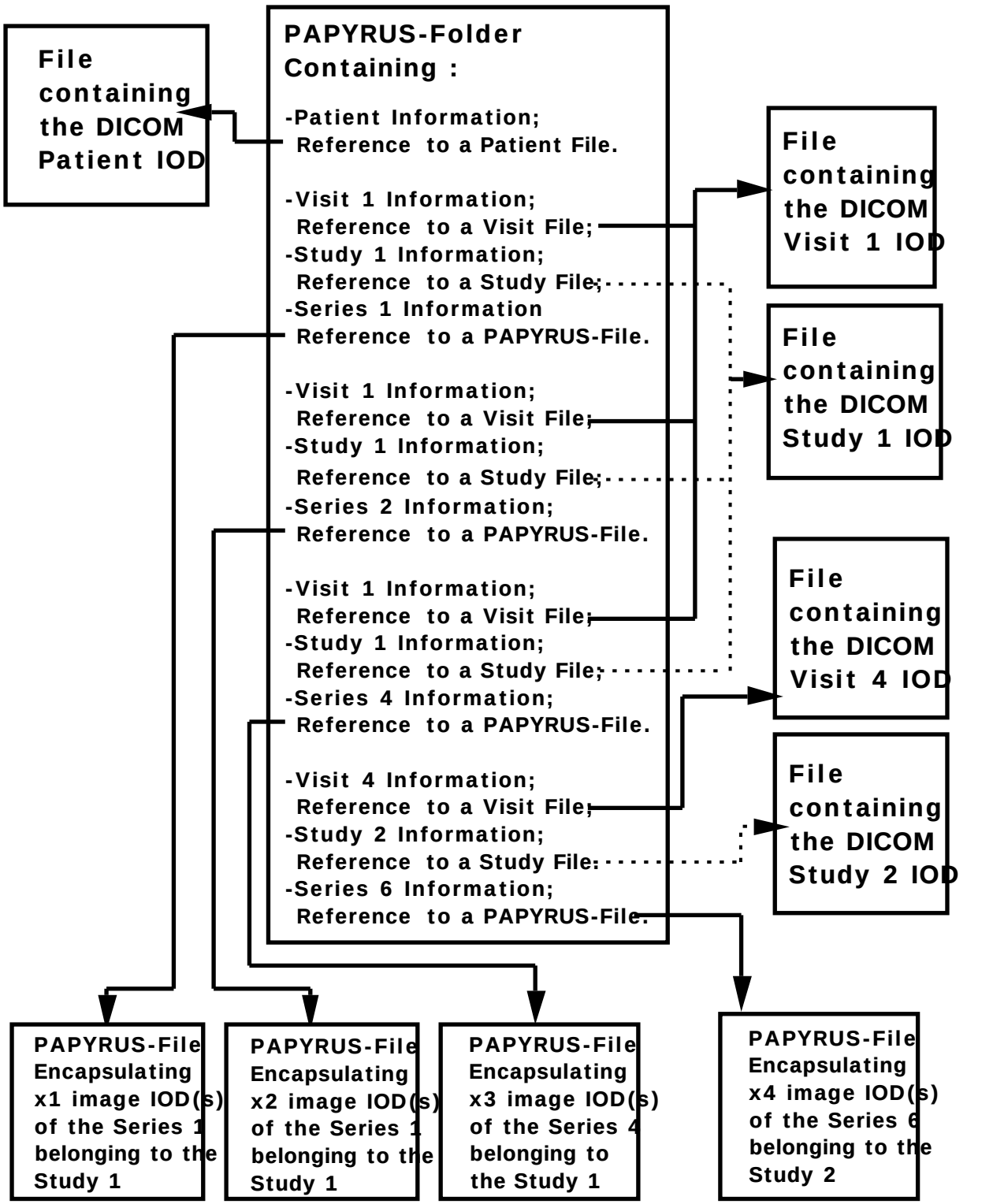
3.3.3. Third application

One or several images of a same Series are stored in the individual *PAPYRUS File*.

Different *PAPYRUS Files*, each containing images of a same series (different *PAPYRUS-Files Objects* may encapsulate different extracts of a same serie) are referenced by the same *PAPYRUS-Folder Object.*

The different Series contained in the different *PAPYRUS Files* may belong to different Studies, possibly from different imaging modalities. They only have to belong to the same patient.

Example 3



note : - x1,x2,x3 and x4 may be equal to one or may be greater.
- The references to files containing Patient, Visit or Study Information are optional.

4. Structure of PAPYRUS Files

4.1 The PAPYRUS-File Structure

This structure permits to encapsulate several *DICOM Image Information Objects* in the same file. The recovery of the images is accelerated by defining some internal pointers referencing the Image Data Sets.

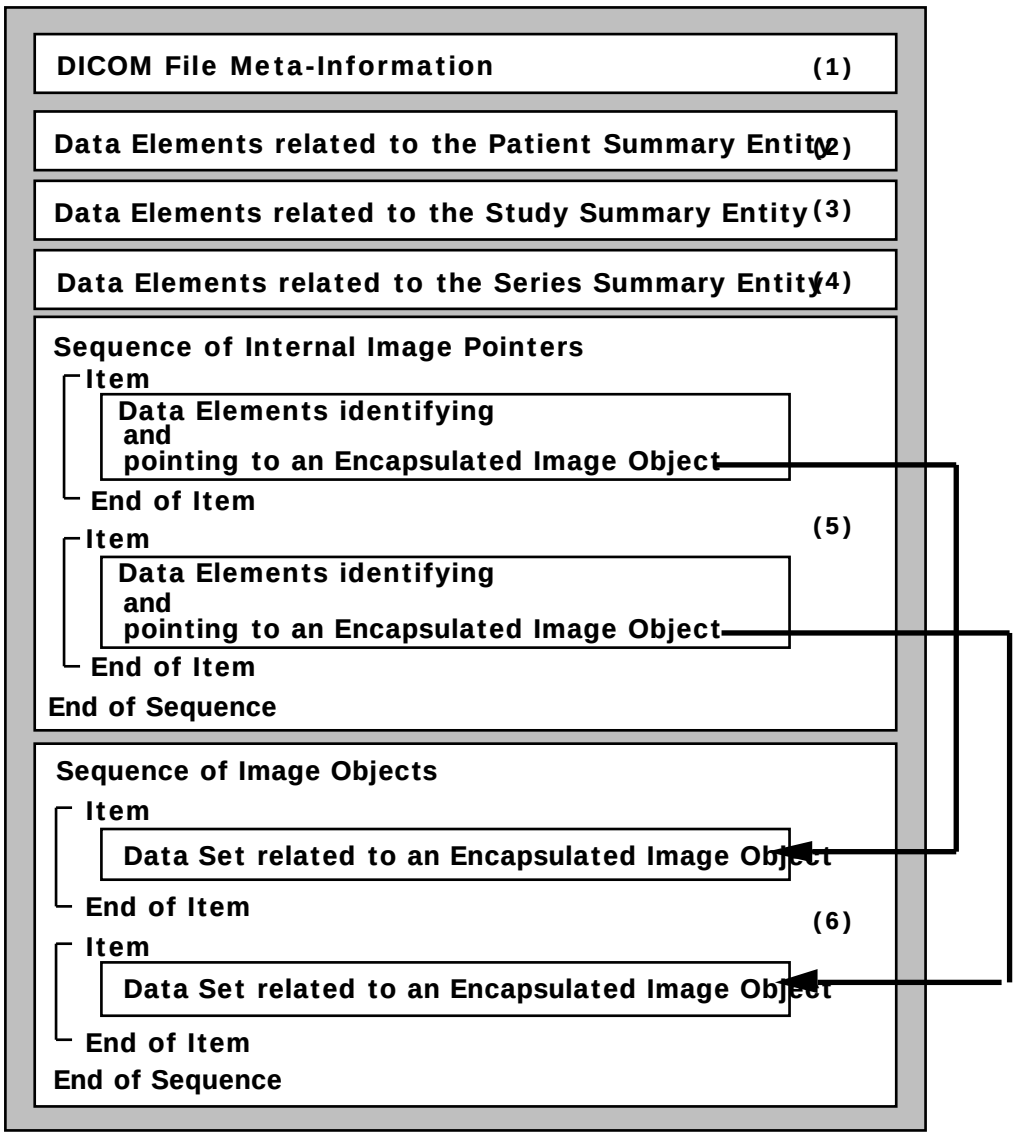


Figure 1: PAPYRUS-File logical structure based on a Series of Information Object.

Note : This disposition is only a schematic disposition and does not correspond to any physical structure (See § 6 and 8) (in the physical structure, data elements related to Patient, Study, Series can be mixed since they must be sorted according to their group number).

Notes :

(1) : Information to identify the information contained in the File.
This information does not belong to the *PAPYRUS-File Object*, but is mandatory in the file in which the Object is stored.
(2), (3) and (4) : Information required to select files.
(5) : Each item contains selected identification attributes and an offset pointer to an image object. It also contains an offset to localize the pixel data.
(6) : Each Item of this sequence is composed of a single image object as defined in the frozen Working Draft of *DICOM V. 3.0* on *Information Object Definitions* .

4.2 The PAPYRUS-Folder Structure

Warning : The structure of Folder is bound to change because this concept is under development in *DICOM Part 10* (Concept of DICOMDIR).

This *PAPYRUS-Folder* Object allows to reference different *PAPYRUS Files*, each containing one or several images of a same Series, and to reference three other files containing respectively the *Patient IOD*, the *Visit IOD* and the *Study IOD*. In a given *PAPYRUS File*, all images must belong to a same Series, but two different *PAPYRUS Files* may contain images from the same Series (an extract of a Series per file). The PAPYRUS-Folder would contain a part of the common attributes and different references to these PAPYRUS-Files.

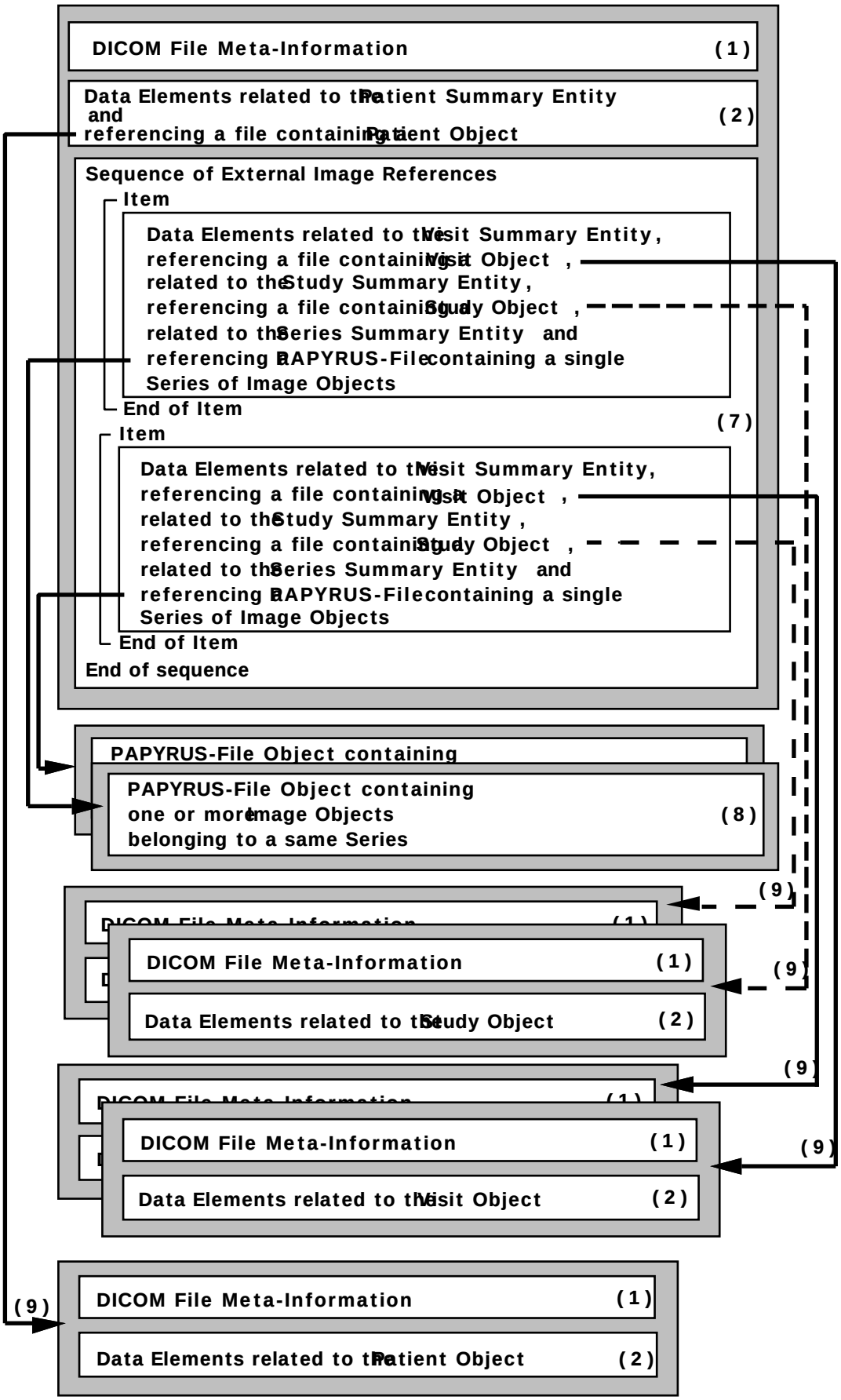


Figure 2: Second structure of *PAPYRUS* file logical structure based on a *PAPYRUS-Folder Object* referencing separate PAPYRUS-File Objects encapsulating one or several image Information Objects

Note : This disposition is only a schematic disposition and does not correspond to any physical structure (See § 6 and 8) (in the physical structure, data elements related to Patient, Study, Series can be mixed since they must be sorted according to their group number).

Notes :

(1) : Information to identify the information contained in the File.
This information does not belong to the *PAPYRUS-Folder Object*, but is mandatory in the file in which the object is stored.
(2) : Information required to select files.
(7) : Each Item is composed of Visit/Study/Series and image identification attributes and a reference to a file containing a single Series which is composed of one or more Images.
(8) : The Data Set corresponding to a PAPYRUS-File defined as above.
(9) : This pointer is optional

Although for storage purposes it is certainly more convenient to keep all images of a given series acquisition in a single file, it is sometimes desirable to store every single image of the same Series in separate files. The latter solution may be also used to reference images from different series for teaching purposes or for documenting a clinical case through a collection of selected images. These images may come from different imaging modalities (each image can be stored in a separate *PAPYRUS File* or each series can be stored in a given *PAPYRUS File* in order to regroup them) and possibly from different studies.
BUT THEY MUST BE FROM THE SAME PATIENT.

5. The Sequence concept

PAPYRUS-File Object and *PAPYRUS-Folder Object* both use the *sequence* concept to regroup one or several *Items*.
This new concept is defined in *DICOM V. 3.0* Part 5 in order to provide a flexible encoding for simple structures of repeating sets of data elements (called items) up the encoding of more complex “folder” information objects.

See **ANNEXE B** for more information.

6. The PAPYRUS Objects

In order to be a proper extension of the *DICOM V 3.0* Standard and to comply with the Part 10 of *DICOM, PAPYRUS* Application Profiles create two new objects :

- The *Images Encapsulation File* (corresponding to a *PAPYRUS-File Object*);
- The *Image File Reference Folder* (corresponding to a *PAPYRUS-Folder Object*).

In order to be conform to *PAPYRUS V 3*, the first structure must be supported by all implementations. The Images Encapsulation File Profile is required.
The Image File Reference Folder Profile is optional.

The Image File Reference Folder Profile also uses existing *DICOM V 3.0* objects :
- Patient;
- Study;
- Visit;

and any of the *DICOM* Objects.

These Patient-File, Visit-File and Study-File Objects are stored in separate files :
- The Patient File;
- The Study File;
- The Visit File;

6.1. The Patient-File Object, the Visit-File Object and the Study-File Object

6.1.1. Description

These new objects provide a mean to *freeze* and store *Patient Object*, *Visit Object* or *Study Object* in separate file. These files contain all information about the *Patient Object*, the *Visit Object* or the *Study Object* as defined in the *DICOM Standard V 3.0* part 3. They are referenced by the *Image File Reference Folder Object* (*PAPYRUS-Folder Object*) as defined below, in order to supply the patient, the visit and the study information associated to the images stored in the *PAPYRUS File*. These three files are both capable of being updated, for example, in order to correct a mistake by overwriting them.

6.1.2. The Patient-File Object

6.1.2.1. Entities and Modules

The*Patient Entity* contains modules that are defined in the frozen Working Draft of *DICOM V 3.0* part 3.

6.1.2.2. Information Object Modules

Entity	Module	Reference	Usage *
Patient	SOP Common	Annexe D Section 1.	M
	Patient Relationship	Annexe D Section 2.1.	M
	Patient Identification	Annexe D Section 2.2.	U
	Patient Demographic	Annexe D Section 2.3.	U
	Patient Medical	Annexe D Section 2.4.	U

*

M (Mandatory) : For each IOD, Mandatory Modules shall be supported per definitions, semantics, and requirements defined in the referenced sections.

C (Conditional) : Conditional Modules are Mandatory Modules if specific conditions are met. If the specified conditions are not met, this module shall not be supported; that is, no information defined in that module shall be present.

U (User Option) : User Option Modules may or may not be supported. All attributes defined in an User Option Modules shall be optional regardless of the Attribute Types specified in the modules in the referenced section.

6.1.3. The Visit-File Object

6.1.3.1. Entities and Modules

The*Visit Entity* contains modules that are defined in the frozen Working Draft of *DICOM V 3.0* part 3.

6.1.3.2. Information Object Modules

Entity	Module	Reference	Usage *
Visit	SOP Common	Annexe D Section 1.	M
	Visit Relationship	Annexe D Section 3.1.	M
	Visit Identification	Annexe D Section 3.2.	U
	Visit Admission	Annexe D Section 3.3.	U
	Visit Stay	Annexe D Section 3.4.	U
	Visit Discharge	Annexe D Section 3.5.	U
	Visit Scheduling	Annexe D Section 3.6.	U

*****

M (Mandatory) : For each IOD, Mandatory Modules shall be supported per definitions, semantics, and requirements defined in the referenced sections.

C (Conditional) : Conditional Modules are Mandatory Modules if specific conditions are met. If the specified conditions are not met, this module shall not be supported; that is, no information defined in that module shall be present.

U (User Option) : User Option Modules may or may not be supported. All attributes defined in an User Option Modules shall be optional regardless of the Attribute Types specified in the modules in the referenced section.

6.1.4 The Study-File Object

6.1.4.1. Entities and Modules

The *Study Entity* contains modules that are defined in the frozen Working Draft of *DICOM V 3.0* part 3.

6.1.4.2. Information Object Modules

Entity	Module	Reference	Usage *
Study	SOP Common	Annexe D Section 1.	M
	Study Relationship	Annexe D Section 4.1.	M
	Study Identification	Annexe D Section 4.2.	U
	Study Classification	Annexe D Section 4.3.	U
	Study Scheduling	Annexe D Section 4.4.	U
	Study Acquisition	Annexe D Section 4.5.	U
	Study Interpretation	Annexe D Section 4.6.	U

*****

M (Mandatory) : For each IOD, Mandatory Modules shall be supported per definitions, semantics, and requirements defined in the referenced sections.

C (Conditional) : Conditional Modules are Mandatory Modules if specific conditions are met. If the specified conditions are not met, this module shall not be supported; that is, no information defined in that module shall be present.

U (User Option) : User Option Modules may or may not be supported. All attributes defined in an User Option Modules shall be optional regardless of the Attribute Types specified in the modules in the referenced section.

6.2. The PAPYRUS-File Object

6.2.1. Description

This new object provides a simple mean to encapsulate one or several images belonging to a same Serie in a single file in order to store it in a storage media.
All these stored images are either standard *DICOM Objects* whose definitions are in the frozen Working Draft of *DICOM V 3.0* on Information Object Definitions (DICOM Part 3) or may be Private Image Objects.

Both, the *sequence of Internal Image Pointers* and the *sequence of Image Data Sets* comply with the definition of the Value Representation "Sequence of Items" described in the frozen Working Draft of *DICOM V 3.0* part 5.

This object is stored on a single file with a *Meta Information Header* as defined in Working Draft on *Media Storage & File Format* (DICOM Part 10).

6.2.2. Entities and Modules

The following modules : *General Patient Summary*, *General Study Summary* and *General Series Summary* contain only basic attributes useful to retrieve images. These attributes are duplicated in order to rapidly identify images and so, accelerate any search.

The *Pointer Module* is used to identify and localize images in the files.

The *Identifying Icon Sequence* contains an undersampled representation of the given image with its representation parameters (Icon Data Set).

The *Image Data Set Module* contains all modules defining an *Image Object* as specified in the frozen Working Draft of *DICOM V 3.0* Part 3 on Information Object Definition.

6.2.3. Information Object Modules

Entity	Module	Reference	Usage *
Patient Summary	General Patient Summary	7.1.1.	M
Study Summary	General Study Summary	7.3.1.	M
Series	General Series Summary	7.4.1.	M
	Internal Image Pointer Sequence	7.4.3.	M
	> Image Identification	7.4.4.	M
	> Icon Image	7.4.5.	U
	> Image Pointer	7.4.6.	M
	> Pixel Offset	7.4.7.	U
	Image Sequence	7.4.8.	M
	> Image Data Set	See the frozen Working Draft of DICOM Vs 3.0 part 3	M

*****

M (Mandatory) : For each IOD, Mandatory Modules shall be supported per definitions, semantics, and requirements defined in the referenced sections.

C (Conditional) : Conditional Modules are Mandatory Modules if specific conditions are met. If the specified conditions are not met, this module shall not be supported; that is, no information defined in that module shall be present.

U (User Option) : User Option Modules may or may not be supported. All attributes defined in an User Option Modules shall be optional regardless of the Attribute Types specified in the modules in the referenced section.

Other usages of DICOM Object Sequence than the one indicated are not permitted in *PAPYRUS-Files Objects*.

6.3. The PAPYRUS-Folder Object

Warning : The structure of Folder is bound to change because this concept is under development in *DICOM* Part 10 (Concept of DICOMDIR).

6.3.1. Description

This object provides some external references to localize images stored in some files, each containing a *PAPYRUS-Files Object* defined as above.
Its structure permits to reference some images stored in separate files (a single image per file) or to reference groups (a Series or an extract of a Series) of images stored in a PAPYRUS-File.
The *Meta Information Header* as defined in the Working Draft on *Media Storage & File Format* (DICOM Part 10) is stored at the beginning of the file containing the *PAPYRUS-Folder Object*.

6.3.2. Entities and Modules

The *General Patient Summary Entity*, the *General Visit Summary*, the *General Study Summary* and *General Series Summary* modules contain only basic attributes useful to retrieve images. They contain duplicated information in order to rapidly identify images and, so accelerate any search.

The modules *External Patient File Reference, External Visit File Reference* and *External Study File Reference* contain information to reference files containing *Patient-File, Visit-File* and *Study-File* objects.

The *PAPYRUS-File* Reference Module references the file where the identified image in the *Image Identification Module* are stored.

The *Identifying Image Sequence* contains an undersampled representation of the image encapsulated in the referenced *PAPYRUS-File Object*. It contains an *Image Identification Module* associated to each icon.

6.3.3. Information Object Modules

Entity	Module	Reference	Usage *
Patient Information	General Patient Summary	7.1.1.	M
	External Patient File Reference Sequence **See note 1**	7.1.2.	U
	>File Reference	7.6.	C**
PAPYRUS-File Reference	External PAPYRUS-File Reference Sequence	7.5.1.	M
	> File Reference	7.6.	M
	> General Visit Summary	7.2.1.	M
	> External Visit File Reference Sequence **See note 2**	7.2.2	U
	>> File Reference	7.6	C**
	> General Study Summary	7.3.1.	M
	> External Study File Reference Sequence **See note 3**	7.3.2.	U
	>>File Reference	7.6.	C**
	> General Series Summary	7.4.1.	M
	> Identifying Image Sequence **See note 4**	7.4.2.	M
	>>Image Identification	7.4.4.	M
	>>Icon Image	7.4.5.	U

*

M (Mandatory) : For each IOD, Mandatory Modules shall be supported per definitions, semantics, and requirements defined in the referenced sections.

C (Conditional) : Conditional Modules are Mandatory Modules if specific conditions are met. If the specified conditions are not met, this module shall not be supported; that is, no information defined in that module shall be present.

U (User Option) : User Option Modules may or may not be supported. All attributes defined in an User Option Modules shall be optional regardless of the Attribute Types specified in the modules in the referenced section.

** Required if an external file reference is present.

Note 1 : This sequence is only used to encapsulate the External Patient File Reference. So this sequence contains **only one Item.**

Note 2 : This sequence is only used to encapsulate the External Visit File Reference. So this sequence contains **only one Item.**

Note 3 : This sequence is only used to encapsulate the External Study File Reference. So this sequence contains **only one Item.**

Note 4 : This Sequence contains as many Items as included images in the referenced PAPYRUS-File.

Other usages of DICOM Object Sequence than these indicated are not permitted in *PAPYRUS-Folder Object*.

7. Module Description

7.1 Patient Summary Entity

7.1.1. General Patient Summary Module

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's full legal name
Patient's ID	(0010,0020)	2	Primary hospital identification number or code for the patient
Patient's Birth Date	(0010,0030)	2	Birth date of the patient
Patient's Sex	(0010,0040)	2	Sex of the patient. Enumerated Values : M = male F = female O = other Other values are not permitted.
Patient's Height	(0010,1020)	3	Patient's height or length in meters
Patient's Weight	(0010,1030)	3	Weight of the patient in kilograms

7.1.2. External Patient File Reference Sequence Module

Attribute Name	Tag	Type	Attribute Description
Referenced Patient Sequence	(0008,1120)	3	A sequence which provides reference to a Patient SOP Class/Instance pair. Encoded as a sequence of items described in the File Reference Module.

7.2. Visit Summary Entity

7.2.1. General Visit Summary Module

Attribute Name	Tag	Type	Attribute Description
Current Patient Location	(0038,0008)	3	Describes the current known location of the patient
Patient's Institution Residence	(0038,0300)	3	Primary location where patient resides (ward, floor, room, etc. or outpatient)
Institution Name	(0008,0080)	3	Institution where equipment is located.

7.2.2. External Visit File Reference Sequence Module

Attribute Name	Tag	Type	Attribute Description
Referenced Visit Sequence	(0008,1125)	3	A sequence which provides reference to a Visit SOP Class/Instance pair. Encoded as a sequence of items described in the File Reference Module.

7.3. Study Summary Entity

7.3.1. General Study Summary Module

Attribute Name	Tag	Type	Attribute Description
Study Date	(0008,0020)	2	Date the study started
Study Time	(0008,0030)	2	Time the study started
Study UID	(0020,000D)	1	UID assigned to the Study
Study ID	(0020,0010)	2	Study identifier
Accession number	(0008,0050)	2	A RIS generated number which identifies the order of Study.
Referring Physician's Name	(0008,0090)	2	Patient's primary referring physician

7.3.2. External Study File Reference Sequence Module

Attribute Name	Tag	Type	Attribute Description
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair. Encoded as a sequence of items described in the File Reference Module.

7.4. Series Entity

7.4.1. General Series Summary Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this series
Series Instance UID	(0020,000E)	1	UID assigned to the Series
Series Number	(0020,0011)	2	A number that identifies this Series
Number of images	(0041,1015)	1	Number of images contained in this file.

7.4.2. Identifying Image Sequence Module

Attribute Name	Tag	Type	Attribute Description
Image Identifier Sequence	(0041,0013)	3	Sequence of repeating Items where each Item includes the attributes of zero or more Icon Modules. **See note.**

note : In **PAPYRUS-Folder Object**, this sequence contains **as many Items** as images included in the referenced *PAPYRUS File*.

7.4.3. Internal Image Pointer Sequence Module

Attribute Name	Tag	Type	Attribute Description
Pointer Sequence	(0041,1010)	1	Sequence of repeating Items where each Item includes the attributes of one or more image pointers

7.4.4. Image Identification Module

Attribute Name	Tag	Type	Attribute Description
Referenced Image SOP Class UID	(0041,1041)	1	UID of the SOP Class of the image in the given PAPYRUS-File
Referenced Image SOP Instance UID	(0041,1042)	1	UID of the SOP Instance of this Encapsulated Image Object in the given PAPYRUS-File.
Image Number	(0020,0013)	2	A number that identifies this image.

7.4.5. Icon Image Module

The Icon Image is a set defining a under-sampled representation of the image.

Attribute Name	Tag	Type	Attribute Description
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image. It shall have an Enumerated Value of 1. Other Value are not permitted.
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data. The following three value are allowed : MONOCHROME1 MONOCHROME2 PALETTE COLOR. Other value are not permitted. **See note 1 & 2**
Rows	(0028,0010)	1	Number of rows in the image. Value greater than 64 are not permitted.
Columns	(0028,0011)	1	Number of columns in the image. Value greater than 64 are not permitted.
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Enumerated value: 0001; 0008. Other value are not permitted.

Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. This value must be equal to the Bits Allocated Value. Enumerated value: 0001; 0008. Other value are not permitted.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. High Bit Value shall have only the Enumerated Value of one less than the value sent in bits stored.
Pixel Representation	(0028,0103)	1	Data representation of the pixel sample. Enumerated Value: 0000 = unsigned integer; **See NOTE 3.**
Red Palette Color Lookup table Descriptors	(0028,1101)	1C	Specifies the format of the Red Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR.
Blue Palette Color Lookup Table Descriptors	(0028,1102)	1C	Specifies the format of the Blue Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR and if Bit Stored value is 8.
green Palette Color Lookup Table Descriptors	(0028,1103)	1C	Specifies the format of the Blue Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR and if Bit Stored value is 8.
Red Palette Color Lookup Table Data	(0028,1201)	1C	Red Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR and if Bit Stored value is 8.
Blue Palette Color Lookup Table Data	(0028,1202)	1C	Blue Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR and if Bit Stored value is 8.
Green Palette Color Lookup Table Data	(0028,1203)	1C	Green Palette Color Lookup Table Data. Required if Photometric interpretation Value is PALETTE COLOR and if Bit Stored value is 8.
Pixel Data	(7FE0,0010)	1	A data stream of pixel sample.

Note 1 :
MONOCHROME1 : Pixel data represent a single monochrome image plane. The minimum sample value is intended to be displayed as white, low optical density, of high luminance.

MONOCHROME2 : Pixel data represent a single monochrome image plane. The minimum sample value is intended to be displayed as black, high optical density, of low luminance.

PALETTE COLOR : Pixel data describe a color image with a sample per pixel (single image plane). The pixel value is used as an index into each of the Red, Blue and Green Palette Color Lookup Table (0028,1101-1103 and 1201-1203). When the Photometric Interpretation is Palette Color, Red, Blue and Green Palette Color Lookup Tables shall be present.

Note 2 :
According to the Modality, the data element (0028,0004) shall have specific restriction:

- CT Modality, MR Modality :
  Photometric interpretation shall have only the following Enumerated Values :
  MONOCHROME1;
  MONOCHROME2.

- US MODALITY :
  Photometric interpretation shall have only the following Enumerated Values :
  MONOCHROME2;
  PALETTE COLOR.

Note 3 :
For monochrome image, the value of each pixel are interpreted as follow :

- 0 corresponds to the minimum sample value of the pixel;
- the high value (255 with a Bits Stored Value of 8, 1 to a Bits Stored Value of 1) corresponds to the maximum sample value of the pixel.

7.4.6. Image Pointer Module

Attribute Name	Tag	Type	Attribute Description
Image Pointer	(0041,1011)	2	A byte count from the beginning of the File to the item start containing the pointed Data Set of the Image Object..

7.4.7. Pixel Offset Module

Attribute Name	Tag	Type	Attribute Description
Pixel Offset	(0041,1012)	3	A byte count which indicates the offset of the first pixel of the Image Object from the beginning of the File.

7.4.8. Image sequence Module

Attribute Name	Tag	Type	Attribute Description
Image Sequence	(0041,1050)	1	Sequence of repeating Items where each Item includes the attributes of zero or more Data Set of an Image Objects

7.5 PAPYRUS File Reference Entity

7.5.1. External PAPYRUS File Reference Sequence Module

Attribute Name	Tag	Type	Attribute Description
External PAPYRUS File Reference Sequence	(0041,1014)	1	Sequence of repeating Items where each Item includes at least the attributes of one or more PAPYRUS File references

7.6 File Reference Module

Attribute Name	Tag	Type	Attribute Description
Referenced SOP Class UID	(0041,1021)	1C	Required if a File Reference Sequence (0008,1110), (0008,1120) or (0041,1014) is sent. Uniquely identifies the SOP Class associated with the Data Set contained in the referenced file.
Referenced SOP Instance UID	(0041,1022)	1C	Required if a File Reference Sequence (0008,1110), (0008,1120) or (0041,1014) is sent. Uniquely identifies the SOP Instance associated with the Data Set placed in the referenced file and following the File Meta Information.
Referenced File Name	(0041,1031)	1C	Required if a File Reference Sequence (0008,1110), (0008,1120) or (0041,1014) is sent. Name of the referenced PAPYRUS File
Referenced File Path	(0041,1032)	1C	Required if a File Reference Sequence (0008,1110), (0008,1120) or (0041,1014) is sent. One or more components See note 1.

Note 1: These components are separated by some “Backslash” in the DICOM Standard.
They represent the different directories composing the path of the file.
To remake a path compatible with an operating system, just change the Backslash in “ / ” for MS-DOS and in “ : ” for DR-DOS etc...
These components must be ordered.

8. Physical Implementation

The Data Elements are stored in the file according to a specific order. In a same group, they are sorted by order the same applies to their group numbers.

At a sequence tag, this order is broken : A sequence is composed of several items, each containing its own attributes. In each item, Data Elements are again classified. The order is broken again at each item start.

So an example of structure is :

```
Group 0002

Group 0008
        .
        .
        .
Group 0038

Group 0041

        (0041,0000)
        (0041,0010)    PAPYRUS 3.0
        (0041,1000)

        /(0041,1010)    Pointer Sequence    (value = length of the sequence
        /                                           or FFFFFFFF if its length is undefined)
        /
        /       /(FFFE,E000)  Item   (value = length of the item
        /       /                                   or FFFFFFFF if its length is undefined)
        /       /       (0041,1011)
        /       /       (0041,1012)
        /       /       (0041,1013) Identifying Icon Sequence (this element is also a sequence data)
        /       /(FFFE,E00D)   Item Delimitation Item  ( in case of undefined length)
        /               .
        /               .
        /               .
        /       /(FFFE,E000)  Item    (value = length of the item
        /       /                                   or FFFFFFFF if its length is undefined)
        /       /       (0041,1011)
        /       /       (0041,1012)
        /       /       (0041,1013) Identifying Icon Sequence (this element is also a sequence data)
        /       /(FFFE,E00D)   Item Delimitation Item   ( in case of undefined length)
        /
        /(FFFE,EODD)  Sequence Delimitation Item   ( in case of undefined length)


        /(0041,1050)       Image Sequence    (value = length of the sequence
        /                                           or FFFFFFFF if its length is undefined)
        /
        /       /(FFFE,E000)  Item   (value = length of the item
        /       /                                   or FFFFFFFF if its length is undefined)
        /       /       group 8
        /       /
        /       /       Group 10
        /       /       Group 20
        /       /         etc
        /       /       Group 7FE0
        /       /(FFFE,E00D)  Item Delimitation Item   ( in case of undefined length)
        /               .
        /               .
        /               .
        /       /(FFFE,E000)  Item   (value = length of the item
        /       /                                   or FFFFFFFF if its length is undefined)
        /       /       group 8
        /       /
        /       /       Group 10
        /       /       Group 20
        /       /         etc
        /       /       Group 7FE0
        /       /(FFFE,E00D)  Item Delimitation Item   ( in case of undefined length)
        /
        /(FFFE,EODD)  Sequence Delimitation Item   ( in case of undefined length)
```

ANNEXE A

DICOM Reminders

Definitions of : IOD, SOP Class, UID.

1. IOD (Information Object Definition) :

Part 3 of the DICOM Standard specifies a number of Information Object Classes which provide an abstract definition of real-world entities applicable to communication of digital medical images. Each Information Object Class definition consists of a description on the purpose of the Information Object and the attributes that define it. An Information Object Class does not include the values for the attributes which comprise its definition.

To represent an actual occurrence of a real-world entity, an Information Object Instance is created, which includes values for the attributes of the Information Object Class. The Attribute Values of this Information Object Instance may change over time to accurately reflect the changing state of the entity which it represents.

(See DICOM Part 3 for more details)

2. SOP Class (Service-Object-Pair Class) :

A Service-Object-Pair (SOP) Class is defined by the union of an IOD and a DIMSE Service Group (a DIMSE - *DICOM Message Service Element* - Service Group specifies a subset of the operations and notifications which are applicable to an IOD). The Sop Class Definition contains the rules and semantics which may extend or restrict the definition of the services in the *DIMSE Service Group* or the Attributes of an IOD.

(See DICOM Part 4 for more details)

3. UID (Unique Identifiers) :

Unique Identifiers (UIDs) provide the capability to uniquely identify a wide variety of items. It quarantees uniqueness across multiple countries, sites, vendors and equipment. This scheme is used in *DICOM* to uniquely identify items such as SOP Classes, image instances, etc.

(See DICOM Part 5 for more details)

ANNEXE B

The Sequence Concept

PAPYRUS-File Object and *PAPYRUS-Folder Object* both use the sequence concept to regroup one or several Items.
This new concept is defined in *DICOM V 3.0* Part 5 in order to provide a flexible encoding for simple structures of repeating sets of data elements (called items) up the encoding of more complex "folder" information objects.

1. A Sequence of Items

A Sequence of Items is a specific data element which value is a succession of set of data elements called the Items and which value representation is "SQ".
Each sequence shall be encoded as a *DICOM* Standard data element with a well defined tag.
This sequence tag is followed by a 4 bytes Sequence Length field. This field contains :

- Either the explicit length of the Items of the Sequence in bytes;
- Either the value "undefined length" (FFFFFFFF). A data element called a Sequence Delimiter indicating the end of the Sequence, shall be included after the last Item. Its tag is (FFFE,E0DD) and it has no value (value length = (00000000)).

2. Items

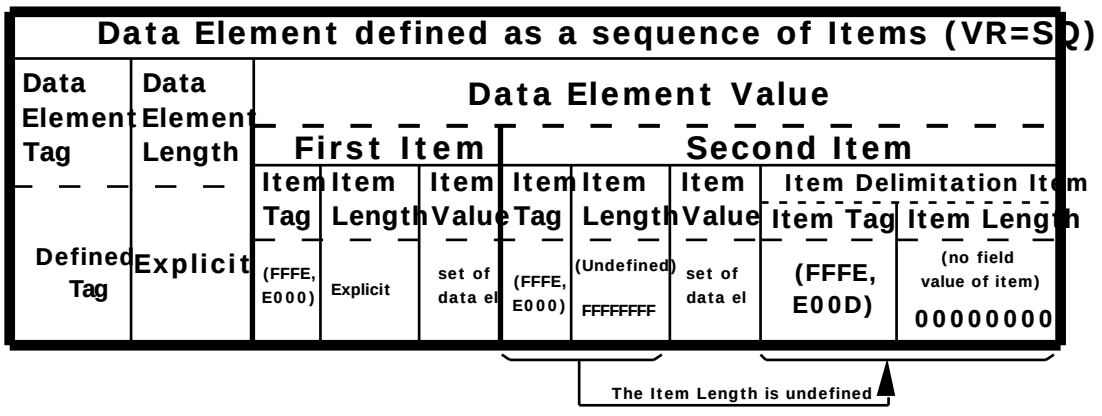
Each Item of a Sequence shall be encoded as a *DICOM* Standard data element with the specific tag (FFFE,E000). The length value field shall contains :

- Either the item length;
- or the "undefined length" (FFFFFFFF). An item Delimiter encapsulated in the item, shall be included after the last element of the item. Its tag is (FFFE,E00D) and its length value field is (00000000) - no value for this data element is allowed.

3. Example of sequence

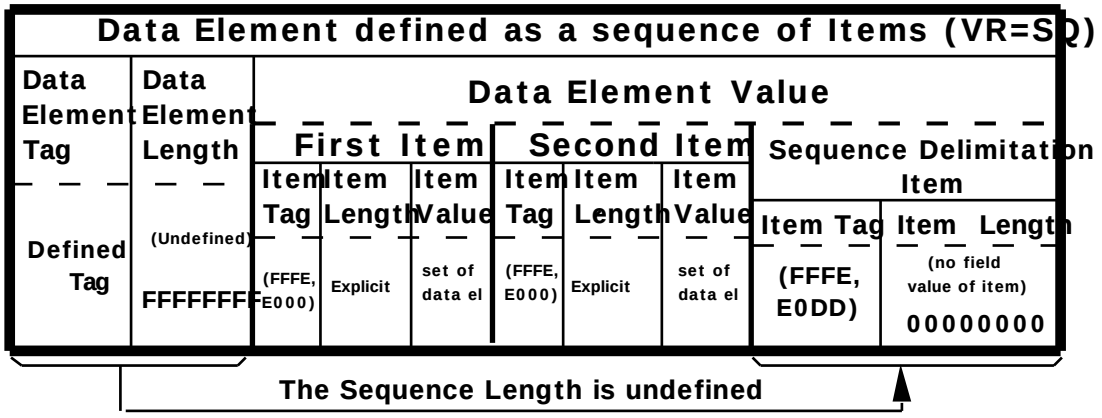
3.1 Sequence with a defined length

This sequence has a defined length and contains two Items. The first item length is defined whereas the second item length is undefined. The second item length field has the value (FFFFFFFF) and has a item delimitation item encapsulated.



3.2 Sequence with a undefined length

This Sequence encapsulates two Items and its length is undefined (length field value is (FFFFFFFF)). So, the value of the data element encapsulates a Sequence Delimitation Item. In this example, both Item lengths are defined but they could be undefined. In a such Item, a Item Delimitation Item should be encapsulated.



4. Consequence of the Sequence concept

The possibility to declared some Sequence Length or some item Length as “undefined” induced some changes to the Data Element (0008,0001) (=Data Set Length-to-End) and (xxxx,0000) (=Group Length).

4.1. Data Set Length-to-End (0008,0001)

This Data Element is retired. Implementation may choose to store it for backward compatibility reasons. PAPYRUS Vs. 3.0 conformant implementation shall not rely on its presence for their operations.

4.2 Group Length (xxxx,0000)

This Data Element shall be made a Type 3 (it was a Type 1 in Version 2.3) Data Element in *PAPYRUS V. 3*. Implementations may chose either to store explicit Group Length for backward compatibility reasons, or not to store them.

5. Conventional Notation

In section 6, ‘>’ was used to identify a ‘Sequence of Modules’. Nested Sequences of Modules were identified by ‘>>’.

6. Advice for Sequence Creator

Although the undefined length sequence and defined length sequence must be supported by all implementations which conform to *PAPYRUS V 3* we advise to create only defined length sequence in order to make easier and accelerate the reading of a file.

ANNEXE C

The DICOM File Meta-Information

The SOP Class UID and the SOP Instance UID in the Meta-Information Header

To store image on an image on a storage media or through a network are two conceptually different SOP Classes. Furthermore, *PAPYRUS* encapsulates several image objects in the same file object.
The SOP Instance UID contained in the Meta-Information header are defined as follow :

The following Standard SOP Classes are identified:

SOP Class Name	DICOM Simple Image Object UID	PAPYRUS File Object UID *
Computed Radiography Image Information Object	1.2.840.10008.5.1.4.1.1.1	
CT Image Information Object	1.2.840.10008.5.1.4.1.1.2	
MR Image Information Object	1.2.840.10008.5.1.4.1.1.4	
Nuclear Medicine Image Information Object	1.2.840.10008.5.1.4.1.1.5	
Ultrasound Image Information Object	1.2.840.10008.5.1.4.1.1.6	
Secondary Capture Image Information Object	1.2.840.10008.5.1.4.1.1.7	

* An officially root UID to construct entire UIDs has been requested.

ANNEXE D

The DICOM Data Elements used to define Patient, Visit and Study Objects

1. SOP Common Module

This following section defines attributes which are required for proper functioning and identification of the associated SOP Instance. They do not specify any semantics about the real world object represented by the IOD.

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class. Defined Terms are specified in Annex C.
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basis Graphic Set. Required if an expanded or replacement character set is used.
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.
Instance Creator UID	(0008,0014)	3	Uniquely identifies device which created the Information Object Instance.

See DICOM Vs 3.0 Part 3 Section C.12.1. for more information.

2. Patient Entity

The following sections specify Modules used for patient management.

2.1. Patient Relationship Module

This table defines the Attributes that reference SOP Instances related to this SOP Class.

Attribute Name	Tag	Type	Attribute Description
Referenced Visit SOP Instance UIDs	(0008,1125)		Uniquely identifies the visits associated with the patient
Referenced Study SOP Instance UIDs	(0008,1110)		Uniquely identifies the Study SOP Instances associated with the Patient SOP Instance.
Referenced Patient Alias SOP Instance UIDs	(0038,0004)		Uniquely identifies any patient information object instances which also describe this patient. These information object instances are aliases.

2.2. Patient Identification Module

This table defines the attributes relevant to identifying a patient.

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's full legal name
Patient ID	(0010,0020)	2	Primary identification number or code for the patient
Issuer of Patient ID	(0010,0021)		Name of healthcare provider which issued the Patient ID
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient
Other Patient Names	(0010,1001)	3	Other names used to identify the patient
Patient's Maiden Name	(0010,1005)		Patient's maiden name
Patient's Mother's Maiden Name	(0010,1060)		Maiden name of patient's mother
Medical Record Locator	(0010,1090)		An identifier used to find the patient's existing medical record (e.g. film jacket)

2.3. Patient Demographic Module

This table defines the attributes relevant to generally describing a patient.

Attribute Name	Tag	Type	Attribute Description
Patient's Address	(0010,1040)		Legal address of the named patient
Region of Residence	(0010,2152)		Region within patient's country of residence
Country of Residence	(0010,2150)		Country in which patient currently resides
Patient's Telephone Numbers	(0010,2154)		Telephone numbers at which the patient can be reached
Patient's Birth Date	(0010,0030)		Date of birth of the named patient
Patient's Birth Time	(0010,0032)	3	Time of birth of the named patient
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values : M = male F = female O = other
Patient's Height	(0010,1020)	3	Patient's height or length in meters
Patient's Weight	(0010,1030)	3	Weight of the patient in kilograms
Military Rank	(0010,1080)		Military rank of the patient
Military Service	(0010,1081)		Branch of the military. The country allegiance may also be included (e.g. U.S.Army)
Insurance Plan References	(0010,1050)		References to insurance plan ID numbers and/or names used by the patient
Patient's Religious Preference	(0010,21F0)		The religious preference of the patient
Patient Comments	(0010,4000)	3	User-defined comments about the patient

2.4. Patient Medical Module

This table defines the Attributes relevant to a patient's medical state or history.

Attribute Name	Tag	Type	Attribute Description
Patient State	(0038,0500)		Description of patient state (comatose, disoriented, vision impaired etc.)
Pregnancy Status	(0010,21C0)		Describes pregnancy state of patient. Enumerated Values : 0001 = not pregnant 0002 = possibly pregnant 0003 = definitely pregnant 0004 = unknown Other values are not permitted.
Medical Alerts	(0010,2000)		Conditions to which medical staff should be alerted (e.g. contagious condition, drug allergies, etc.)
Contrast Allergies	(0010,2110)		Description of prior reaction to contrast reagents
Special needs	(0038,0050)		Medical and social needs (e.g. wheelchair, oxygen, non-English-speaking etc.)
Last Menstrual Date	(0010,21D0)		Date of onset of last menstrual period
Smoking Status	(0010,21A0)		Indicates whether patient smokes. Enumerated values: YES, NO, UNKNOWN
Additional Patient's History	(0010,21B0)	3	Additional information about the patient's medical history

3. Visit Entity

The following sections specify Modules relevant to a real world patient visit.

3.1. Visit Relationship Module

This module contains the Attributes which reference SOP Instances related to this SOP Class.

Attribute Name	Tag	Type	Attribute Description
Referenced Study SOP Instance UIDs	(0008,1110)		Uniquely identifies the study SOP Instances associated with the Visit SOP instance.
Referenced Patient SOP Instance UID	(0008,1120)		Uniquely identifies the Patient SOP Instance that relates to the Visit SOP Instance.

3.2. Visit Identification Module

This table defines the Attributes relevant to identifying a visit.

Attribute Name	Tag	Type	Attribute Description
Institution ID	(0008,0079)		Identifier of the Institution/healthcare provider visited by patient.
Institution Name	(0008,0080)		Institution where the equipment is located.
Institution Address	(0008,0081)		Mailing Address of the institution where the equipment is located.
Issuer of Institution ID	(0008,0082)		Name of organization which issued the Institution ID
Admission ID	(0038,0010)		Identification number of the visit as assigned by healthcare provider.
Issuer of Admission ID	(0038,0011)		Name of healthcare provider which issued the Admission ID.

3.3. Visit status Module

This table defines the Attributes relevant to the Patient's stay with the healthcare provider.

Attribute Name	Tag	Type	Attribute Description
Visit Status ID	(0038,0008)		Identifies the state of the Visit. Defined terms : CREATED = Created but not yet scheduled; SCHEDULED = scheduled but not yet admitted; ADMITTED = Patient admitted to institution; DISCHARGED = Patient discharged.
Current Patient Location	(0038,0300)		Describes the current known location of the patient.
Patient's Institution Residence	(0038,0400)		Primary location where patient resides (ward, floor, room, etc. or outpatient).
Comments	(0038,4000)		User-defined comments about the visit.

3.4. Visit Admission Module

This table defines the Attributes relevant to admitting a patient during a visit.

Attribute Name	Tag	Type	Attribute Description
Admitting Date	(0038,0020)		Date patient visit began.
Admitting Time	(0038,0021)		Time patient visit began.
Route of Admissions	(0038,0016)		Mode of admission : emergency, normal.
Admitting Diagnosis Description	(0008,1080)		Description of admitting diagnosis
Admitting Diagnosis Coding Scheme UID	(0008,1082)		Uniquely identifies the diagnosis coding scheme used to classify the admitting diagnosis. Defined terms : 1.2.840.10008.3.1.3.2.1 = ACR 1.2.840.10008.3.1.3.2.2 = ICD-9 1.2.840.10008.3.1.3.2.3 = ICD-10 1.2.840.10008.3.1.3.2.4 = CLIP
Admitting Diagnosis Code	(0008,1084)		Code (value) of the admitting diagnosis from the table identified in Admitting Diagnosis Coding Scheme UID (0008,1082)
Referring Physician	(0008,0090)		Patient's primary referring physician for this visit.
Referring Physician Address	(0008,0092)		Referring Physician's Address
Referring Physician Phone Numbers	(0008,0094)		Referring Physician's Phone Numbers

3.5. Visit Discharge Module

This table defines the Attributes relevant to the discharging of a patient from a visit.

Attribute Name	Tag	Type	Attribute Description
Discharge Date	(0038,0030)		Date patient visit ended or is scheduled to end.
Discharge Time	(0038,0032)		Time patient visit ended or is scheduled to end.
Discharge Diagnosis Description	(0038,0040)		Institution-generated description of discharge diagnosis.
Discharge Diagnosis Coding Scheme UID	(0038,0042)		Uniquely identifies the diagnosis coding scheme used to classify the discharge diagnosis. Defined terms : 1.2.840.10008.3.1.3.2.1 = ACR 1.2.840.10008.3.1.3.2.2 = ICD-9 1.2.840.10008.3.1.3.2.3 = ICD-10 1.2.840.10008.3.1.3.2.4 = CLIP
Discharge Diagnosis Code	(0038,0044)		Code (value) of the discharge diagnosis from the table identified in Discharge Diagnosis Coding Scheme UID (0038,0042)

3.6. Visit Scheduling Module

This table defines the Attributes relevant to the scheduling of a patient visit.

Attribute Name	Tag	Type	Attribute Description
Scheduled Admission Date	(0038,001A)		Date patient visit is scheduled to start
Scheduled Admission Time	(0038,001B)		Time patient visit is scheduled to start
Scheduled Discharge Date	(0038,001C)		Date patient visit is scheduled to end
Scheduled Discharge Time	(0038,001D)		Time patient visit is scheduled to end
Scheduled Patient Institution residence	(0038,001E)		Scheduled location where patient is to reside (ward, floor, room, etc. or outpatient)

4. Study Entity

The following sections specify Modules relevant to a rel world diagnosis imaging study performed on a patient.

4.1. Study Relationship Module

This table defines the Attributes which reference SOP Instances Subordinate or Superior to this SOP Class in the Naming Hierarchy.

Attribute Name	Tag	Type	Attribute Description
Referenced Visit SOP Instance UIDs	(0008,1125)		Uniquely identifies the visit SOP Instance during which this study SOP Instance was acquired
Referenced Patient SOP Instance UID	(0008,1120)		Uniquely identifies the Patient SOP Instance that relates to the Visit SOP Instance
Referenced Result SOP Instance UID	(0008,1100)		Uniquely identifies the Result SOP Instance for which the interpretation SOP Instance applies.
Study Instance UID	(0020,000D)		UID assigned to the Study
Accession Number	(0008,1160)		A RIS generated number which identifies the order for the Study.

4.2. Study Identification Module

This table defines the Attributes relevant to identifying a study.

Attribute Name	Tag	Type	Attribute Description
Study ID	(0020,0010)	2	User or equipment generated study identifier
Study ID Issuer	(0032,0012)		Name of healthcare provider which issued the Study ID
Other Study Numbers	(0020,1070)		Other identifiers assigned to study by institution

4.3. Study Classification Module

This table defines the Attributes relevant to classifying a study.

Attribute Name	Tag	Type	Attribute Description
Procedure Description	(0008,1030)	3	Institution-generated description or classification of study
Procedure Coding Scheme UID	(0008,1031)		Uniquely identifies the coding scheme used to classify the procedure. Defined values : 1.2.840.10008.3.1.3.1.1 = CPT-4 1.2.840.10008.3.1.3.1.2 = CPT-5 1.2.840.10008.3.1.3.1.3 = B-30 1.2.840.10008.3.1.3.1.4 = OPCS-4 Other values may be privately defined.
Procedure Code	(0008,1032)		Code which identifies the procedure using the scheme in Procedure Coding Scheme UID (0008,1031)

Study Status ID	(0032,000A)		Identifies the state of the study. Enumerated values : CREATED = Created but not yet scheduled SCHEDULED = Scheduled but not yet started ARRIVED = Patient arrived but study not started STARTED = Started but not yet finished COMPLETED = Complete but image quality not verified VERIFIED = Complete with image quality verified READ = Read by the Physicians Other values are not permitted.
Study Priority ID	(0032,000C)		Identifies the priority of the study. Enumerated values : 0000H = Medium 0001H = High 0002H = Low Other values are not permitted
Comments	(0032,4000)		User-defined comments about the study

4.4. Study Scheduling Module

This table defines the Attributes relevant to scheduling a study.

Attribute Name	Tag	Type	Attribute Description
Scheduled Study Start Date	(0032,1000)		Date on which the study is scheduled to start
Scheduled Study Start Time	(0032,1001)		Time at which the study is scheduled to start
Scheduled Study Stop date	(0032,1010)		Date on which the patient examination for the study is scheduled to end
Scheduled Study Stop Time	(0032,1011)		Time on which the patient examination for the study is scheduled to end
Scheduled Study Location	(0032,1020)		User-defined location at which the study will be performed
Scheduled Study Location Application Entity Title	(0032,1021)		Application Entity Title of the location at which the study will be performed.
Reason for study	(0032,1030)		Describes reason for performing study
Requesting Physician	(0032,1032)		Physician who requested the study
Requested Procedure Description	(0032,1060)		Institution-generated description or classification of requested procedure

Requested Procedure Primary Coding Scheme UID	(0032,1062)		Uniquely identifies the coding scheme used to classify the requested procedure. Defined values : 1.2.840.10008.3.1.3.1.1 = CPT-4 1.2.840.10008.3.1.3.1.2 = CPT-5 1.2.840.10008.3.1.3.1.3 = B-30 1.2.840.10008.3.1.3.1.4 = OPCS-4 Other values may be privately defined.
Requested Procedure Primary Code	(0032,1064)		Code which identifies the requested procedure using the scheme in Requested Procedure Coding Scheme UID (0032,1062)
Requested Contrast Agent	(0032,1070)		Contrast agent requested for use in the procedure

4.5. Study Acquisition Module

This table defines the Attributes relevant to acquiring in study.

Attribute Name	Tag	Type	Attribute Description
Study Arrival Date	(0032,1080)		Date that patient arrived at study check-in-location
Study Arrival Time	(0032,1081)		Time at which patient arrived at study check-in-location
Attending Physician	(0008,1050)	2	Physician administering the study
Study Date	(0008,0020)	2	Date on which the acquisition of the study information was started
Study Time	(0008,0030)	2	Time at which the acquisition of the study information was started
Study Completion Date	(0032,1050)		Date on which the acquisition of the study information was completed
Study Completion Time	(0032,1051)		Time at which the acquisition of the study information was completed
Study Verified Date	(0032,0032)		Date on which the image quality for the patient examination was verified
Study Verified Time	(0032,0033)		Time at which the image quality for the patient examination was verified
Series in Study	(0020,1000)		Number of series in the study
Acquisition in Study	(0020,1004)		Number of image data acquisitions used in performing the study

4.6. Study Interpretation Module

This Module is equivalent to the Study Read Module defined in DICOM Part 3 section C.4.6.

This table defines the Attributes relevant to the reading of a study.

Attribute Name	Tag	Type	Attribute Description
Name of Physician(s) Reading Study	(0008,1060)		Physician(s) reading the study
Study Read Date	(0032,0034)		Date on which the study was read
Study Read Time	(0032,0035)		Time at which the study was read

ANNEXE E

The PAPYRUS Data Elements

GROUP	ELEMENT	NAME	VR	VM	DEFINED TERMS
0041	0000	Group Length	UL	1	
0041	0010	Owner ID	LO	1	PAPYRUS 3.0
0041	1000	Comments	LT	1	
0041	1010	Pointer Sequence	SQ	1	
0041	1011	Image Pointer	UL	1	
0041	1012	Pixel Offset	UL	1	
0041	1013	Image Identifier Sequence	SQ	1	
0041	1014	External PAPYRUS-File Reference Sequence	SQ	1	
0041	1015	Number of images	US	1	
0041	1021	Referenced SOP Class UID	UI	1	
0041	1022	Referenced SOP Instance UID	UI	1	
0041	1031	Referenced File Name	LO	1	
0041	1032	Referenced File Path	LO	1-n	
0041	1041	Referenced Image SOP Class UID	UI	1	
0041	1042	Referenced Image SOP Instance UID	UI	1	
0041	1050	Image Sequence	SQ	1	

ANNEXE F

The UIN overlays Data Elements

GROUP	ELEMENT	NAME	VR	VM	DEFINED TERMS
6xxx	0000	Group Length	UL	1	
6xxx	00xx	Owner ID	LT	1	PAPYRUS 3.0
6xxx	xx00	Overlay ID	IS	1	
6xxx	xx01	Linked Overlays	LT	1-n	
6xxx	xx10	Overlays Rows	US	1	
6xxx	xx11	Overlays Columns	US	1	
6xxx	xx40	Overlay Type	LO	1	RECTANGLE, ANNOTATION, GRAPHIC
6xxx	xx50	Overlay Origin	US	1-n	
6xxx	xx60	Editable	LO	1	
6xxx	xx70	Overlay Font	LO	1	TIMES, HELVETICA
6xxx	xx72	Overlay Style	LO	1	NORMAL. BOLD, ITALIC, BOLDITALIC
6xxx	xx74	Overlay Font Size	US	1	
6xxx	xx76	Overlay Color	LO	1-n	WHITE, BLACK, RED, GREEN. BLUE, CYAN, MAGENTA, YELLOW
6xxx	xx78	Shadow Size	US	1	
6xxx	xx80	Fill Pattern	LO	1	NONE, OPAQUE, TRANSPARENT
6xxx	xx82	Overlay Pen Size	US	1	
6xxx	xxA0	Label	LO	1	
6xxx	xxA2	Post It Text	LT	1	
6xxx	xxA4	Anchor Point	US	1-n	
6xxx	xxB0	ROI Type	LO	1	MASK, RECT, ELLIPSE, POLYGON
6xxx	xxB2	Attached Annotation	LT	1	
6xxx	xxBA	Contour Points	US	1-n	
6xxx	xxBC	Mask Data	US	1-n	
6xxx	xxC0	UIN Overlay Sequence	SQ	1	