PS3.11

DICOM PS3.11 ~~2026b~~2026c - Media Storage Application Profiles

PS3.11: DICOM PS3.11 ~~2026b~~2026c - Media Storage Application Profiles

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Table of Contents

Notice and Disclaimer 11
Foreword 13
1. Scope and Field of Application 15
2. Normative References 17
3. Definitions 19
4. Symbols and Abbreviations 23
5. Conventions 25
6. Purpose of a Media Storage Application Profile 27
7. Conformance Requirements 29
8. Structure of Media Storage Application Profile 31
X.1. Class and Profile Identification 31
X.2. Clinical Context 31
X.2.1. Roles and Service Class Options 31
X.3. General Class Profile 31
X.3.1. SOP Classes and Transfer Syntaxes 31
X.3.2. Physical Media and Media Formats 32
X.3.3. Directory Information in DICOMDIR 32
X.3.4. Other Parameters 32
X.4. Specific Media Storage Application Profiles 32
X.3.5. Security Parameters 32
A. Basic Cardiac X-Ray Angiographic Media Storage Application Profile (Normative) 33
A.1. Class and Profile Identification 33
A.2. Clinical Context 33
A.2.1. Roles and Service Class Options 33
A.2.1.1. File-set Creator 34
A.2.1.2. File-set Reader 34
A.2.1.3. File-set Updater 34
A.3. STD-XABC-CD Basic Cardiac Profile 34
A.3.1. SOP Classes and Transfer Syntaxes 34
A.3.2. Physical Media and Media Formats 35
A.3.3. Directory Information in DICOMDIR 35
A.3.3.1. Additional Keys 35
A.3.3.2. Icon Images 36
A.3.4. Other Parameters 36
A.3.4.1. Image Attribute Values 36
A.3.4.1.1. Attribute Value Precedence 36
B. 1024 X-Ray Angiographic Media Storage Application Profile (Normative) 37
B.1. Class and Profile Identification 37
B.2. Clinical Context 37
B.2.1. Roles and Service Class Options 37
B.2.1.1. File-set Creator 37
B.2.1.2. File-set Reader 38
B.2.1.3. File-set Updater 38
B.3. STD-XA1K Media Storage Application Profile Class Requirements 38
B.3.1. SOP Classes and Transfer Syntaxes 38
B.3.2. Physical Media and Media Formats 39
B.3.3. Directory Information in DICOMDIR 39
B.3.3.1. Additional Keys 39
B.3.3.2. Icon Images 40
B.3.4. Other Parameters 40
B.3.4.1. Image Attribute Values 41
B.3.4.2. Multi-frame JPEG Format 41
B.3.4.3. Attribute Value Precedence 41
C. Ultrasound Media Storage Application Profile (Normative) 43
C.1. Class and Profile Identification 43
C.2. Clinical Context 43
C.2.1. Roles 44

C.2.1.1. File-set Creator 44
C.2.1.2. File-set Reader 44
C.2.1.3. File-set Updater 44
C.3. General Class Profile 44
C.3.1. SOP Classes and Transfer Syntaxes 44
C.3.1.1. Ultrasound Single and Multi-frame Pixel Formats Supported 45
C.3.2. Physical Media and Media Formats 45
C.3.3. DICOMDIR 46
C.3.3.1. Additional Keys 46
C.3.3.2. File Component IDs 46
C.4. Spatial Calibration (SC) Class Requirements 46
C.5. Combined Calibration (CC) Class Requirements 46
D. General Purpose CD-R, DVD and BD Interchange Profiles (Normative) 47
D.1. Profile Identification 47
D.2. Clinical Context 47
D.2.1. Roles and Service Class Options 48
D.2.1.1. File-set Creator 48
D.2.1.2. File-set Reader 48
D.2.1.3. File-set Updater 48
D.3. STD-GEN Profile Class 49
D.3.1. SOP Classes and Transfer Syntaxes 49
D.3.2. Physical Medium and Medium Format 49
D.3.3. Directory Information in DICOMDIR 49
D.3.3.1. Additional Keys 49
D.3.3.2. Attribute Value Precedence 50
D.3.4. Other Parameters 50
D.3.5. Security Parameters 50
E. CT and MR Image Media Storage Application Profiles (Normative) 51
E.1. Profile Identification 51
E.2. Clinical Context 51
E.2.1. Roles and Service Class Options 51
E.2.1.1. File-set Creator 51
E.2.1.2. File-set Reader 52
E.2.1.3. File-set Updater 52
E.3. STD-CTMR Profiles 52
E.3.1. SOP Classes and Transfer Syntaxes 52
E.3.2. Physical Medium and Medium Format 53
E.3.3. Directory Information in DICOMDIR 54
E.3.3.1. Additional Keys 54
E.3.3.2. Localizer Related Attributes 54
E.3.3.3. Icon Images 54
E.3.4. Other Parameters 54
E.3.4.1. Image Attribute Values 55
E.3.4.1.1. Attribute Value Precedence 56
F. Waveform Diskette Interchange Profile (Normative) 57
G. General Purpose MIME Interchange Profile (Normative) 59
G.1. Profile Identification 59
G.2. Clinical Context 59
G.2.1. Roles and Service Class Options 59
G.2.1.1. File-set Creator 59
G.2.1.2. File-set Reader 60
G.3. STD-GEN-MIME Profile 60
G.3.1. SOP Classes and Transfer Syntaxes 60
G.3.2. Physical Medium and Medium Format 60
G.3.3. Directory Information in DICOMDIR 60
G.3.3.1. Additional Keys 61
H. General Purpose DVD With Compression Interchange Profiles (Normative) 63
H.1. Profile Identification 63
H.2. Clinical Context 63
H.2.1. Roles and Service Class Options 64

H.2.1.1. File-set Creator 64
H.2.1.2. File-set Reader 64
H.2.1.3. File-set Updater 64
H.3. STD-GEN-DVD and STD-GEN-SEC-DVD Profile Classes 64
H.3.1. SOP Classes and Transfer Syntaxes 64
H.3.2. Physical Medium and Medium Format 65
H.3.3. Directory Information in DICOMDIR 65
H.3.3.1. Additional Keys 66
H.3.4. Other Parameters 67
H.3.4.1. Multi-frame JPEG Format 67
H.3.5. Security Parameters 67
I. DVD MPEG2 Interchange Profiles (Normative) 69
I.1. Profile Identification 69
I.2. Clinical Context 69
I.2.1. Roles and Service Class Options 69
I.2.1.1. File-set Creator 69
I.2.1.2. File-set Reader 70
I.2.1.3. File-set Updater 70
I.3. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Profile Classes 70
I.3.1. SOP Classes and Transfer Syntaxes 70
I.3.2. Physical Medium and Medium Format 70
I.3.3. Directory Information in DICOMDIR 70
I.3.3.1. Additional Keys 70
I.3.4. Security Parameters 71
I.3.5. "dual-format" (informative) 71
J. General Purpose USB and Flash Memory With Compression Interchange Profiles (Normative) 73
J.1. Profile Identification 73
J.2. Clinical Context 74
J.2.1. Roles and Service Class Options 74
J.2.1.1. File-set Creator 75
J.2.1.2. File-set Reader 75
J.2.1.3. File-set Updater 75
J.3. STD-GEN-USB, STD-GEN-SEC-USB, STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD Profile Classes 75
J.3.1. SOP Classes and Transfer Syntaxes 75
J.3.2. Physical Medium and Medium Format 76
J.3.3. Directory Information in DICOMDIR 76
J.3.3.1. Additional Keys 77
J.3.4. Other Parameters 77
J.3.4.1. Multi-frame JPEG Format 77
J.3.5. Security Parameters 77
K. Dental Media Storage Application Profile (Normative) 79
K.1. Class and Profile Identification 79
K.2. Clinical Context 79
K.2.1. Roles 80
K.2.1.1. File-set Creator 80
K.2.1.2. File-set Reader 80
K.2.1.3. File-set Updater 80
K.3. General Class Profile 80
K.3.1. SOP Classes and Transfer Syntaxes 80
K.3.2. Physical Media and Media Formats 81
K.3.3. Directory Information in DICOMDIR 81
K.3.4. Other Parameters 81
K.3.4.1. Image Attribute Values 81
K.3.4.2. Image Attribute Specialization 81
L. ZIP File Over Email Interchange Profiles (Normative) 83
L.1. Profile Identification 83
L.2. Clinical Context 83
L.2.1. Roles 83
L.2.1.1. File-set Creator 83

L.2.1.2. File-set Reader 83
L.2.1.3. File-set Updater 84
L.3. General Class Profile 84
L.3.1. STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes 84
L.3.2. Medium Format 84
L.3.3. Directory Information in DICOMDIR 84
L.3.3.1. Additional Keys 85
L.3.4. Secure Transport 85
L.4. Dental Class Profile 85
L.4.1. STD-DTL-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes 85
L.4.2. Medium Format 85
L.4.3. Directory Information in DICOMDIR 85
L.4.4.1. Additional Keys 86
L.4.5. Specific Image Requirements For STD-DTL-SEC-ZIP-MAIL 86
L.4.6. Secure Transport 86
M. General Purpose BD With Compression Interchange Profiles (Normative) 87
M.1. Profile Identification 87
M.2. Clinical Context 88
M.2.1. Roles and Service Class Options 88
M.2.1.1. File-set Creator 88
M.2.1.2. File-set Reader 89
M.2.1.3. File-set Updater 89
M.3. STD-GEN-BD and STD-GEN-SEC-BD Profile Classes 89
M.3.1. SOP Classes and Transfer Syntaxes 89
M.3.2. Physical Medium and Medium Format 91
M.3.3. Directory Information in DICOMDIR 91
M.3.3.1. Additional Keys 91
M.3.4. Other Parameters 91
M.3.4.1. Multi-frame JPEG Format 91
M.3.5. Security Parameters 91
N. General Purpose BD With MPEG-4 AVC/H.264 Level 4.2 Compression Interchange Profiles (Normative) 93
N.1. Profile Identification 93
N.2. Clinical Context 94
N.2.1. Roles and Service Class Options 94
N.2.1.1. File-set Creator 94
N.2.1.2. File-set Reader 94
N.2.1.3. File-set Updater 95
N.3. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Profile Classes 95
N.3.1. SOP Classes and Transfer Syntaxes 95
N.3.2. Physical Medium and Medium Format 95
N.3.3. Directory Information in DICOMDIR 96
N.3.3.1. Additional Keys 96
N.3.4. Security Parameters 96

List of Figures

6-1. Relationship Between a Media Storage Application Profile and Parts of DICOM 28
A.2-1. Basic Cardiac X-Ray Angiographic Clinical Context 33
C.2-1. Ultrasound Clinical Context 44
K.2-1. Dental Clinical Context 79

List of Tables

A.1-1. Basic Cardiac XA Profile 33
A.3-1. STD-XABC-CD SOP Classes and Transfer Syntaxes 34
A.3-2. STD-XABC-CD Additional DICOMDIR Keys 35
A.3-3. STD-XABC-CD- Required Image Attribute Values 36
B.1-1. 1024 X-Ray Angiographic Profiles 37
B.3-1. STD-XA1K SOP Classes and Transfer Syntaxes 38
B.3-2. STD-XA1K Additional DICOMDIR Keys 40
B.3-3. STD-XA1K Required XA Image Attribute Values 41
B.3-4. STD-XA1K Required SC Image Attribute Values 41
C.1-1. Ultrasound Media Storage Application Profile identifiers 43
C.3-1. Ultrasound SOP Classes and Transfer Syntaxes 45
C.3-2. Defined Photometric Interpretation and Transfer Syntax Pairs 45
C.3-3. Media Classes 45
D.1-1. STD-GEN Profile 47
D.3-1. STD-GEN-CD, STD-GEN-DVD-RAM, STD-GEN-SEC-CD, STD-GEN-SEC-DVD-RAM, STD-GEN-BD, STD-GEN-SEC-BD SOP Classes and Transfer Syntaxes 49
D.3-2. STD-GEN Additional DICOMDIR Keys 50
E.1-1. STD-CTMR Profiles 51
E.3-1. STD-CTMR SOP Classes and Transfer Syntaxes 52
E.3-2. STD-CTMR Additional DICOMDIR Keys 54
E.3-3. STD-CTMR Required Image Attribute Values for CT Images 55
E.3-4. STD-CTMR Required Image Attribute Values for MR Images 55
E.3-5. STD-CTMR Required Image Attribute Values for Grayscale SC Images 55
E.3-6. STD-CTMR Required Image Attribute Values for Color SC Images 56
G.1-1. STD-GEN-MIME Profile 59
G.3-1. STD-GEN-MIME SOP Classes and Transfer Syntaxes 60
H.1-1. STD-GEN-DVD and STD-GEN-SEC-DVD Profiles 63
H.3-1. STD-GEN-DVD and STD-GEN-SEC-DVD SOP Classes and Transfer Syntaxes 65
H.3-2. STD-GEN-DVD and STD-GEN-SEC-DVD Additional DICOMDIR Keys 66
I.1-1. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Profiles 69
I.3-1. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML SOP Classes and Transfer Syntaxes 70
I.3-2. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Additional DICOMDIR Keys 71
J.1-1. STD-GEN-USB, STD-GEN-SEC-USB STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD Profiles 73
J.3-1. STD-GEN-USB, STD-GEN-SEC-USB, STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD SOP Classes and Transfer Syntaxes 76
K.1-1. Dental Media Storage Application Profile identifiers 79
K.3-1. STD-DEN-CD SOP Classes and Transfer Syntaxes 80
K.3-3. STD-DEN-CD - Required Image Attribute Values 81
K.3-4. STD-DEN-CD - Required Image Attribute Types 81
L.1-1. STD-x-ZIP-MAIL Media Storage Application Profiles 83
L.3-1. STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes 84
L.3-2. STD-DTL-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes 85
L.4-1. STD-DTL-ZIP-MAIL - Required Image Attribute Values 86
L.4-2. STD-DTL-ZIP-MAIL - Required Image Attribute Types 86
M.1-1. STD-GEN-BD and STD-GEN-SEC-BD Profiles 87
M.3-1. STD-GEN-BD and STD-GEN-SEC-BD SOP Classes and Transfer Syntaxes 89
N.1-1. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Profiles 93
N.3-1. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 SOP Classes and Transfer Syntaxes 95

Notice and Disclaimer

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Foreword

This DICOM Standard was developed according to the procedures of the DICOM Standards Committee.

The DICOM Standard is structured as a multi-part document using the guidelines established in [ISO/IEC Directives, Part 2].

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1 Scope and Field of Application

This Part of the DICOM Standard specifies application specific subsets of the DICOM Standard to which an implementation may claim conformance. Such a conformance statement applies to the interoperable interchange of medical images and related information on storage media for specific clinical uses. It follows the framework, defined in PS3.10, for the interchange of various types of information on storage media.

This Part is related to other parts of the DICOM Standard in that:

- PS3.2, Conformance, specifies the general rules for assuring interoperability, which are applied for media interchange through the Media Storage Application Profiles of this Part
- PS3.3, Information Object Definitions, specifies a number of Information Object Definitions (e.g., various types of images) that may be used in conjunction with this Part. It also defines a medical Directory structure to facilitate access to the objects stored on media
- PS3.4, Service Class Specifications, specifies the Media Storage Service Class upon which Media Storage Application Profiles are built
- PS3.5, Data Structure and Encoding, addresses the encoding rules necessary to construct a Data Set that is encapsulated in a file as specified in PS3.10
- PS3.6, Data Dictionary, contains an index by Tag of all Data Elements related to the Attributes of Information Objects defined in PS3.3. This index includes the Value Representation and Value Multiplicity for each Data Element
- PS3.10, Media Storage and File Formats for Media Interchange, standardizes the overall open Storage Media architecture used by this Part, including the definition of a generic File Format, a Basic File Service and a Directory concept
- PS3.12, Media Formats and Physical Media, defines a number of standard Physical Media and corresponding Media Formats. These Media Formats and Physical Media selections are referenced by one or more of the Media Storage Application Profiles of this Part. PS3.12 is intended to be extended as the technologies related to Physical Medium evolve
- PS3.15, Security Profiles defines a number of profiles for use with Secure DICOM Media Storage Application Profiles. The Media Storage Security Profiles specify the cryptographic techniques to be used for each Secure DICOM File in a Secure Media Storage Application Profile.

2 Normative References

The following standards contain provisions that, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibilities of applying the most recent editions of the standards indicated below.

[ISO/IEC Directives, Part 2] ISO/IEC. 2021. 9.0. *Rules for the structure and drafting of International Standards*. http://www.iso.org/sites/directives/current/part2/index.xhtml .

[ISO 7498-1] ISO. 1994. *Information Processing Systems - Open Systems Interconnection - Basic Reference Model*.

[ISO 7498-2] ISO. 1989. *Information processing systems - Open Systems Interconnection - Basic reference Model - Part 2: Security Architecture*.

3 Definitions

For the purposes of this Standard the following definitions apply.

3.1 Reference Model Definitions

This Part of the Standard makes use of the following terms defined in [ISO 7498-1] and [ISO 7498-2]:

Application Entity	See [ISO 7498-1].
Service	See [ISO 7498-1].
Transfer Syntax	See [ISO 7498-1].
Data Confidentiality	See [ISO 7498-2]. Note The definition is "the property that information is not made available or disclosed to unauthorized individuals, entities or processes."
Data Origin Authentication	See [ISO 7498-2]. Note The definition is "the corroboration that the source of data received is as claimed."
Data Integrity	See [ISO 7498-2]. Note The definition is "the property that data has not been altered or destroyed in an unauthorized manner."
Key Management	See [ISO 7498-2]. Note The definition is "the generation, storage, distribution, deletion, archiving and application of keys in accordance with a security policy."

3.2 DICOM Introduction and Overview Definitions

This Part of the Standard makes use of the following terms defined in PS3.1 of the DICOM Standard:

Attribute	See Attribute in PS3.1.
Service Object Pair Class (SOP Class)	See Service-Object Pair Class in PS3.1.

3.3 DICOM Conformance

This Part of the Standard makes use of the following terms defined in PS3.2 of the DICOM Standard:

Conformance Statement	See Conformance Statement in PS3.2.
Standard SOP Class	See Standard SOP Class in PS3.2.
Standard Extended SOP Class	See Standard Extended SOP Class in PS3.2.
Specialized SOP Class	See Specialized SOP Class in PS3.2.

Private SOP Class	See Private SOP Class in PS3.2.
Standard Media Storage Application Profile	See Standard Application Profile in PS3.2.
Augmented Media Storage Application Profile	See Augmented Application Profile in PS3.2.
Private Media Storage Application Profile	See Private Application Profile in PS3.2.

3.4 DICOM Information Object Definitions

This Part of the Standard makes use of the following terms defined in PS3.3 of the DICOM Standard:

Information Object Definition (IOD)	See Information Object Definition in PS3.3.
Basic Directory IOD	See Basic Directory IOD in PS3.3.
Basic Directory Information Model	See Basic Directory Information Model in PS3.3.
Multi-frame Image	See Multi-frame Image in PS3.3.

3.5 DICOM Data Structure and Encoding Definitions

This Part of the Standard makes use of the following terms defined in PS3.5 of the DICOM Standard:

Data Element	See Data Element in PS3.5.
Data Set	See Data Set in PS3.5.

3.6 DICOM Message Exchange Definitions

This Part of the Standard makes use of the following terms defined in PS3.7 of the DICOM Standard:

Implementation Class UID	See Implementation Class UID in PS3.7.

3.7 DICOM Media Storage and File Format Definitions

This Part of the Standard makes use of the following terms defined in PS3.10 of the DICOM Standard:

Media Storage Application Profile	See Media Storage Application Profile in PS3.10.
DICOM File Format	See DICOM File Format in PS3.10.
DICOM File Service	See DICOM File Service in PS3.10.
DICOM File	See DICOM File in PS3.10.
DICOMDIR File	See DICOMDIR File in PS3.10.
File	See File in PS3.10.
File ID	See File ID in PS3.10.
File Meta Information	See File Meta Information in PS3.10.
File-set	See File-set in PS3.10.

DICOM Media Storage Model	See DICOM Media Storage Model in PS3.10.
Secure DICOM File	See Secure DICOM File in PS3.10.
Secure Media Storage Application Profile	See Secure Media Storage Application Profile in PS3.10.

3.8 Media Storage Application Profiles

The following definitions are commonly used in this Part of the Standard:

Media Storage Application Profile Class	A group of related Media Storage Application Profiles defined in a single Annex to PS3.11.

3.9 DICOM Service Class Definitions

This Part of the Standard makes use of the following terms defined in PS3.4 of the DICOM Standard:

Service Object Pair Instance (SOP Instance)	See Service-Object Pair Instance in PS3.4.

4 Symbols and Abbreviations

The following symbols and abbreviations are used in this Part of the Standard.

ACC	American College of Cardiology
ACR	American College of Radiology
ASCII	American Standard Code for Information Interchange
AE	Application Entity
ANSI	American National Standards Institute
BD	Blu-ray Disc™ (that is a trademark of Blu-ray Disc™ Association)
CEN TC 251	Comite Europeen de Normalisation - Technical Committee 251 - Medical Informatics
CF	CompactFlash card
DICOM	Digital Imaging and Communications in Medicine
DVD	A trademark of the DVD Forum that is not an abbreviation
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
HL7	Health Level 7
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Taskforce
IS&C	Image Save and Carry
ISO	International Standards Organization
ID	Identifier
IOD	Information Object Definition
JIRA	Japan Medical Imaging and Radiological Systems Industries Association
MIME	Multipurpose Internet Mail Extension
MMC	Multimedia Card
NEMA	National Electrical Manufacturers Association
OSI	Open Systems Interconnection
RFC	Request for Comments
SD	Secure Digital card
SMTP	Simple Mail Transfer Protocol
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol

UDF Universal Disk Format

UID Unique Identifier

USB Universal Serial Bus

VR Value Representation

5 Conventions

Words are capitalized in this document to help the reader understand that these words have been previously defined in Section 3 of this document and are to be interpreted with that meaning.

6 Purpose of a Media Storage Application Profile

A Media Storage Application Profile is a mechanism for selecting an appropriate set of choices from the parts of DICOM for the support of a particular media interchange application. Media Storage Application Profiles for commonly used interchange scenarios, such as inter-institutional exchange of X-Ray cardiac angiographic examinations, or printing ultrasound studies from recordable media, are meant to use the flexibility offered by DICOM without resulting in so many media and format choices that interchange is compromised.

Media interchange applications claim conformance to one or more Media Storage Application Profiles. Two implementations that conform to identical Media Storage Application Profiles and support complementary File-set roles (e.g., an FSC interchanging media with an FSR) are able to exchange SOP Instances (pieces of DICOM information) on recorded media within the context of those Media Storage Application Profiles.

A DICOM Media Storage Application Profile specifies:

a. which SOP Classes and options must be supported, including any required extensions, specializations, or privatizations

b. for each SOP Class, which Transfer Syntaxes may be used

c. what information should be included in the Basic Directory IOD

d. which Media Storage Service Class options may be utilized

e. which roles an application may take: File-set Creator, File-set Reader, and/or File-set Updater

f. which physical media and corresponding media formats must be supported

g. whether or not the DICOM Files in the File-set shall be Secure DICOM Files

h. which Media Storage Security Profile must be used for the creation of Secure DICOM Files

and any additional conformance requirements.

The result of making the necessary choices means that the Media Storage Application Profile can be thought of as a vertical path through the various parts of DICOM that begins with choices of information to be exchanged and ends at the physical medium. Figure 6-1 shows the relationship between the concepts used in a Media Storage Application Profile and the parts of DICOM.

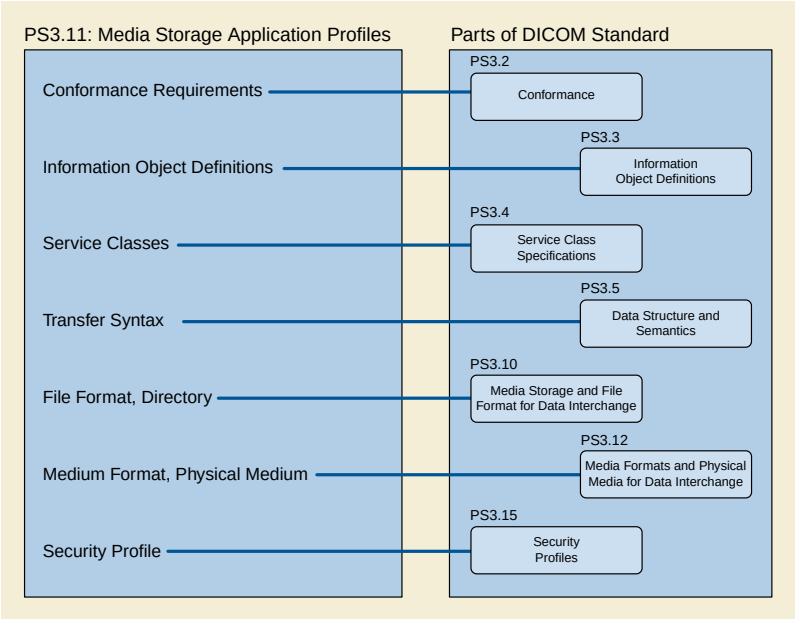

Figure 6-1. Relationship Between a Media Storage Application Profile and Parts of DICOM

A Media Storage Application Profile is organized into the following major parts:

a. The name of the Media Storage Application Profile, or the list of Media Storage Application Profiles grouped in a related class

b. A description of the clinical context of the Media Storage Application Profile

c. The definition of the Media Storage Service Class with the device Roles for the Media Storage Application Profile and associated options

d. Informative section describing the operational requirements of the Media Storage Application Profile

e. Specification of the SOP Classes and associated IODs supported and the Transfer Syntaxes to be used

f. The selection of Media Format and Physical Media to be used

g. If the Directory Information Module is used, the description of the minimum subset of the Information Model required

h. Other parameters that need to be specified to ensure interoperable media interchange

i. Security parameters that select the cryptographic techniques to be used with Secure Media Storage Application Profiles

The structure of DICOM and the design of the Media Storage Application Profile mechanism is such that extension to additional SOP Classes and new exchange media is straightforward.

7 Conformance Requirements

Implementations may claim conformance to one or more PS3.11 Media Storage Application Profiles in a Conformance Statement as outlined in PS3.2.

Note

Additional specific conformance requirements for a Media Storage Application Profile may be listed in the Media Storage Application Profile definition.

8 Structure of Media Storage Application Profile

Media Storage Application Profiles specific to various clinical areas are defined in the Annexes to this Part. Each Annex defines a Media Storage Application Profile Class related to a single area of medical practice, e.g., cardiology, or to a single functional context, e.g., image transfer to a printer system. Several specific Media Storage Application Profiles may be defined in each Media Storage Application Profile class, and an identification scheme is established to label each specific Media Storage Application Profile.

An example of a Media Storage Application Profile structure is provided in below. The section identifier "X" should be replaced by the identifier of the annex.

X.1 Class and Profile Identification

Section X.1 of the Media Storage Application Profile defines the class and specific Media Storage Application Profiles in that class.

This section assigns an identifier to each Media Storage Application Profile of the form ttt-x...x-y...y, where "ttt" indicates the type of Media Storage Application Profile, "x...x" is an abbreviation of a significant term for the clinical context and "y...y" is a significant term for a distinguishing feature of the specific Media Storage Application Profile. The "ttt" type term shall be one of STD, AUG, or PRI, indicating whether the Media Storage Application Profile is a Standard, Augmented, or Private Media Storage Application Profile respectively (see PS3.2). Identifiers shall be written such that they may be encoded with LO (Long String) Value Representation (see PS3.5).

Note

Conformance Statements may use the earlier prefix of APL, which is equivalent to STD. This use is deprecated and may be retired in future editions of the Standard.

X.2 Clinical Context

Section X.2 of the Media Storage Application Profile shall describe the clinical need for the interchange of medical images and related information on storage media, and its context of application. This section shall not require any specific functionality of the Application Entities exchanging information using media interchange beyond their capabilities in the roles of File-set Creator, File-set Reader, and File-set Updater.

Note

This Section does not, for example, place any graphical presentation or performance requirements on workstations that read DICOM interchange media. Such requirements are beyond the scope of a DICOM Media Storage Application Profile. The requirements that fall within the scope of a Media Storage Application Profile are the specific functional storage media interchange capabilities associated with the defined roles.

X.2.1 Roles and Service Class Options

Section X.2.1 describes the Service Class Options used and the contextual application of the roles of File-set Creator, File-set Reader, and File-set Updater.

X.3 General Class Profile

Section X.3 defines characteristics of the Media Storage Application Profile Class that are constant across all specific Media Storage Application Profiles in the class.

X.3.1 SOP Classes and Transfer Syntaxes

Section X.3.1 lists the SOP Classes and Transfer Syntaxes common to all specific Media Storage Application Profiles in the class, if any. This section specifies which SOP Classes are mandatory and optional for the roles of FSC, FSR, and FSU, including any required groupings or SOP options.

X.3.2 Physical Media and Media Formats

Section X.3.2 defines the physical media and corresponding media formats common to all specific Media Storage Application Profiles in the class, if any.

This section also specifies any file service functionality beyond the DICOM File Service required by the clinical application to be supplied by the Media Format Layer.

X.3.3 Directory Information in DICOMDIR

Section X.3.3 specifies the type of Directory Records that shall be supported and any additional associated keys. It also defines any extensions to or specializations of the Basic Directory Information Object Definition, if any.

X.3.4 Other Parameters

Section X.3.4 is optional; if present, it should define any other parameters common to all specific Media Storage Application Profiles in the class, which may need to be specified in order to ensure interoperable media interchange.

X.4 Specific Media Storage Application Profiles

Section X.4 and following, each define the unique characteristics of a specific Media Storage Application Profile. If there are any Media Storage Application Profile specific changes to IODs, Transfer Syntax, DICOMDIR, or other general class requirements, they should be described for each Media Storage Application Profile that specifies such changes.

X.3.5 Security Parameters

Section X.3.5 is optional; if absent, the Media Storage Application Profile is unsecure and the Secure DICOM File Format shall not be used for any DICOM File in the File-set.

If present, this section defines the Media Storage Security Profile to be used for encapsulating *all* DICOM Files in the File-set, including the DICOM Directory. If this section is present, the Media Storage Application Profile is called *Secure Media Storage Application Profile*.

A Basic Cardiac X-Ray Angiographic Media Storage Application Profile (Normative)

A.1 Class and Profile Identification

This Annex defines a Media Storage Application Profile Class for Basic Cardiac X-Ray Angiographic clinical applications.

The identifier for this class shall be STD-XABC. This annex is concerned only with cardiac angiography.

The specific Media Storage Application Profile in this class is shown in the Table A.1-1.

Note

This table contains only a single Media Storage Application Profile. It is expected that additional Media Storage Application Profiles may be added to PS3.11.

Table A.1-1. Basic Cardiac XA Profile

Media Storage Application Profile	Identifier	Description
Basic Cardiac X-Ray Angiographic Studies on CD-R Media	STD-XABC-CD	It handles single frame or multi-frame digital images up to 512x512x8 bits; biplane acquisitions are encoded as two single plane information objects.

A.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of primary digital X-Ray cine runs, typically acquired as part of cardiac catheterization procedures. Typical media interchanges would be from in-lab acquisition equipment to either a display workstation or to a data archive system, or between a display workstation and a data archive system (in both directions). This context is shown in Figure A.2-1.

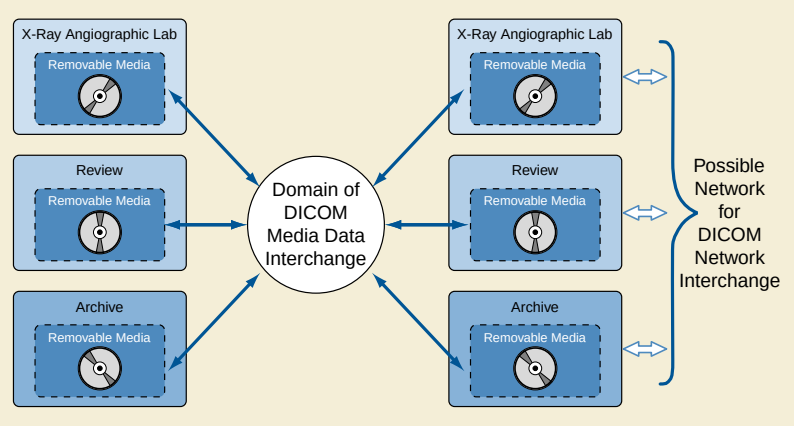

Figure A.2-1. Basic Cardiac X-Ray Angiographic Clinical Context

The operational use of media interchange is potentially both intra-institutional and inter-institutional.

A.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator, File-set Reader, and File-set Updater, defined in PS3.10.

A.2.1.1 File-set Creator

The Application entity acting as a File-set Creator generates a File-set under the STD-XABC Media Storage Application Profile Class. Typical entities using this role would include X-Ray angiographic lab equipment, and archive systems that generate a patient record for transfer to another institution. File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR File with all types of Directory Records related to the SOP Classes stored in the File-set.

FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disk).

Note

A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Media Storage Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one CD-R, the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single CD-R media controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to indicate that there is more than one disc for this set of files (e.g., a study).

A.2.1.2 File-set Reader

The role of File-set Reader is used by Application Entities that receive a transferred File-set. Typical entities using this role would include display workstations, and archive systems that receive a patient record transferred from another institution. File-set Readers shall be able to read all the SOP Classes defined for the specific Media Storage Application Profile for which a Conformance Statement is made, using all the defined Transfer Syntaxes.

A.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set and update it by the addition of information. Typical entities using this role would include analytic workstations, which, for instance, may add to the File-set an information object containing a processed (e.g., edge-enhanced) image. Stations that update patient information objects would also use this role. File-set Updaters do not have to read the images. File-set Updaters shall be able to generate one or more of the SOP Instances defined for the specific Media Storage Application Profile for which a conformance statement is made, and to read and update the DICOMDIR file.

FSU shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disk).

Note

If the disc has not been closed out, the File-set Updater shall be able to update information assuming there is enough space on the disc to write a new DICOMDIR file, the information, and the fundamental CD-R control structures. CD-R control structures are the structures that are inherent to the CD-R standards, see PS3.12.

A.3 STD-XABC-CD Basic Cardiac Profile

A.3.1 SOP Classes and Transfer Syntaxes

This Media Storage Application Profile is based on the Media Storage Service Class (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by this Media Storage Application Profile are specified in the Table A.3-1.

Table A.3-1. STD-XABC-CD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Mandatory	Mandatory	Optional

Note

1. This Media Storage Application Profile does not allow the use of the X-Ray Angiographic Bi-Plane Image Storage SOP Class. Biplane acquisitions must therefore be transferred as two single plane SOP Instances.

2. This Media Storage Application Profile includes only the X-Ray Angiographic Image Storage SOP Class. It does not include Standalone Curve, Modality LUT, VOI LUT, or Overlay Storage SOP Classes.

A.3.2 Physical Media and Media Formats

Basic Cardiac Media Storage Application Profiles in the STD-XABC class require the 120 mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

A.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

A.3.3.1 Additional Keys

Table A.3-2 specifies the type of Directory Records that shall be supported and the additional associated keys. Refer to the Basic Directory IOD in PS3.3.

Table A.3-2. STD-XABC-CD Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Patient's Birth Date	(0010,0030)	PATIENT	2	
Patient's Sex	(0010,0040)	PATIENT	2	
Institution Name	(0008,0080)	SERIES	2	
Institution Address	(0008,0081)	SERIES	2	
Performing Physicians' Name	(0008,1050)	SERIES	2	
Icon Image Sequence	(0088,0200)	IMAGE	1	
Image Type	(0008,0008)	IMAGE	1	
Calibration Image	(0050,0004)	IMAGE	2	
Referenced Image Sequence	(0008,1140)	IMAGE	1C	Required if the SOP Instance referenced by the Directory Record has an Image Type (0008,0008) of BIPLANE A or BIPLANE B. May be present otherwise.

Key Attribute	Tag	Directory Record Type	Type	Notes
>Referenced SOP Class UID	(0008,1150)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>Referenced SOP Instance UID	(0008,1155)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>All other Attributes from Referenced Image Sequence (including Purpose of Reference Code Sequence and its content)		IMAGE	3	

A.3.3.2 Icon Images

Directory Records of type IMAGE shall include Icon Images. The icon pixel data shall be supported with Bits Allocated (0028,0100) equal to 8 and Row (0028,0010) and Column (0028,0011) attribute values of 128.

Note

1. This icon size is larger than that recommended in PS3.10 because the 64x64 icon would not be clinically useful for identifying and selecting X-Ray angiographic images.
2. For Multi-frame Images, it is recommended that the icon image be derived from the frame identified in the Representative Frame Number attribute (0028,6010), if defined for the image SOP Instance. If the Representative Frame Number is not present, a frame approximately one-third of the way through the Multi-frame Image should be selected. The process to reduce a 512x512 image to a 128x128 image is beyond the scope of this Standard.

A.3.4 Other Parameters

This section defines other parameters common to all specific Media Storage Application Profiles in the STD-XABC class that need to be specified in order to ensure interoperable media interchange.

A.3.4.1 Image Attribute Values

The attributes listed in Table A.3-3 used within the X-Ray Angiographic Image files shall take the values specified.

Table A.3-3. STD-XABC-CD- Required Image Attribute Values

Attribute	Tag	Value
Modality	(0008,0060)	XA
Rows	(0028,0010)	512 (see below)
Columns	(0028,0011)	512 (see below)
Bits Allocated	(0028,0100)	8
Bits Stored	(0028,0101)	8

When creating or updating a File-set, Rows or Columns shall not exceed a value of 512. When reading a File-set, an FSR or FSU shall accept a value of at least 512 for Rows or Columns.

Overlay data, if present, shall be encoded in Overlay Data (60XX,3000).

A.3.4.1.1 Attribute Value Precedence

Retired. See PS3.11 2004.

Note

The retired Detached Patient Management SOP Class was previously suggested to allow patient identification and demographic information to be updated without changing the composite Image IOD files. This usage is now retired.

B 1024 X-Ray Angiographic Media Storage Application Profile (Normative)

B.1 Class and Profile Identification

This Annex defines a class of Media Storage Application Profiles for 1024 X-Ray Angiographic clinical applications. The identifier for this class shall be STD-XA1K. It is the intent of these profiles to be backward compatible with the Basic Cardiac X-Ray Angiographic Media Storage Application Profile (STD-XABC-CD) in Annex A.

The specific Media Storage Application Profiles in this class are shown in the Table B.1-1.

Table B.1-1. 1024 X-Ray Angiographic Profiles

Media Storage Application Profile	Identifier	Description
1024 X-Ray Angiographic Studies on CD-R Media	STD-XA1K-CD	It handles single frame or multi-frame X-Ray digital images up to 1024x1024x12 bits; biplane acquisitions are encoded as two single plane information objects. Secondary Capture images are supported.
1024 X-Ray Angiographic Studies on DVD Media	STD-XA1K-DVD	It handles single frame or multi-frame X-Ray digital images up to 1024x1024x12 bits; biplane acquisitions are encoded as two single plane information objects. Secondary Capture images are supported.

B.2 Clinical Context

This class of Media Storage Application Profiles facilitates the interchange of primary digital X-Ray cine runs, typically acquired as part of angiographic procedures. Typical media interchanges would be from in-lab acquisition equipment to either a display workstation or to a data archive system, or between a display workstation and a data archive system (in both directions).

Additionally, images derived from or related to primary digital X-Ray cine runs, such as quantitative analysis images, reference images, multi-modality images and screen capture images, may be interchanged via this Profile.

The operational use of the media interchange is potentially both intra-institutional and inter-institutional.

Note

An FSC conforming to the Basic 512 Cardiac Angiographic Profile and General Purpose CD-R Profile supporting the SC Image Media Storage SOP Class could, if the restrictions in this profile were observed, create images that were readable by an FSR supporting the profile. Conversely, SC Images written by an FSC conforming to this profile, would be readable by an FSR conforming to the Basic 512 Cardiac Angiographic Profile and the General Purpose CD-R Profile supporting the SC Image Media Storage SOP Class.

B.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator, File-set Reader, and File-set Updater, defined in PS3.10.

B.2.1.1 File-set Creator

The Application entity acting as a File-set Creator generates a File-set under the STD-XA1K Media Storage Application Profile Class. Typical entities using this role would include X-Ray angiographic lab equipment, and archive systems that generate a patient record for transfer to another institution. File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR File with all types of Directory Records related to the SOP Classes stored in the File-set.

An FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc). An FSC may allow packet-writing if supported by the media and file system specified in the profile.

Note

A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Media Storage Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one piece of media, the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single piece of media controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to reflect that there is more than one disc for this set of files (e.g., a Study).

B.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set. Typical entities using this role would include display workstations, and archive systems that receive a patient record transferred from another institution. File-set Readers shall be able to read all the defined SOP Instances defined for the specific Media Storage Application Profiles to which a conformance claim is made, using all the defined Transfer Syntaxes.

B.2.1.3 File-set Updater

The role of File-set Updater shall be used by Application Entities that receive a transferred File-set and update it by the addition of processed information. Typical entities using this role would include analytic workstations, which for instance may add to the File-set an information object containing a processed (e.g., edge-enhanced) image frame. Stations that update patient information objects would also use this role. File-set Updaters shall be able to read and update the DICOMDIR file. File-set Updaters do not have to read the image information object. File-set Updaters shall be able to generate one or more of the SOP Instances defined for the specific Media Storage Application Profiles to which a conformance claim is made, and to read and update the DICOMDIR file.

An FSU shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

Note

If the disc has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the disc to write a new DICOMDIR file, the information, and the fundamental volume control structures. Volume control structures are the structures that are inherent to the standards of the physical volume; see PS3.12

The FSU role is not defined for the STD-XA1K-DVD profile.

B.3 STD-XA1K Media Storage Application Profile Class Requirements

B.3.1 SOP Classes and Transfer Syntaxes

This Media Storage Application Profile Class is based on the Media Storage Service Class (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by this Media Storage Application Profile are specified in Table B.3-1.

Table B.3-1. STD-XA1K SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement (see Note 1)
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement (see Note 1)
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Mandatory	Mandatory	Optional
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Baseline (Process 1) 1.2.840.10008.1.2.4.50	Optional for DVD; Disallowed for CD	Mandatory for DVD; Disallowed for CD	Undefined for DVD; Disallowed for CD
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Extended (Process 2 & 4) 1.2.840.10008.1.2.4.51	Optional for DVD; Disallowed for CD	Mandatory for DVD; Disallowed for CD	Undefined for DVD; Disallowed for CD
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory	Optional
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional	Optional

Note

1. The FSU requirement is not defined for STD-XA1K-DVD profile.

2. The Standalone Overlay Storage, Standalone Curve Storage and Detached Patient Management SOP Classes were formerly defined in these profiles, but have been retired. The Grayscale Softcopy Presentation State Storage SOP Class has been added as the preferred mechanism for conveying annotations.

B.3.2 Physical Media and Media Formats

The 1024 X-Ray Angiographic Application CD-R Profile STD-XA1K-CD requires the 120mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

The 1024 X-Ray Angiographic Application DVD profile STD-XA1K-DVD requires any of the 120 mm DVD media other than DVD-RAM as defined in PS3.12.

B.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

B.3.3.1 Additional Keys

Table B.3-2 specifies the type of Directory Records that shall be supported and the additional associated keys. Refer to the Basic Directory IOD in PS3.3.

Table B.3-2. STD-XA1K Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Patient's Birth Date	(0010,0030)	PATIENT	2	
Patient's Sex	(0010,0040)	PATIENT	2	
Institution Name	(0008,0080)	SERIES	2	
Institution Address	(0008,0081)	SERIES	2	
Performing Physicians' Name	(0008,1050)	SERIES	2	
Icon Image Sequence	(0088,0200)	IMAGE	1	
Image Type	(0008,0008)	IMAGE	1C	Required if the SOP Instance referenced by the Directory Record is an XA Image.
Calibration Image	(0050,0004)	IMAGE	2	
Referenced Image Sequence	(0008,1140)	IMAGE	1C	Required if the SOP Instance referenced by the Directory Record is an XA Image and has an Image Type (0008,0008) value 3 of BIPLANE A or BIPLANE B. May be present otherwise.
>Referenced SOP Class UID	(0008,1150)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>Referenced SOP Instance UID	(0008,1155)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>All other Attributes from Referenced Image Sequence (including Purpose of Reference Code Sequence and its content)		IMAGE	3	
Lossy image Compression Ratio	(0028,2112)	IMAGE	1C	Required if present in image object with a non-zero length value.

B.3.3.2 Icon Images

Directory Records of type IMAGE shall include Icon Images. The icon pixel data shall be Bits Allocated and Bits Stored (0028,0101) attribute values of 8 with Row (0028,0010) and Column (0028,0011) attribute values of 128 and Photometric Interpretation (0028,0004) attribute value of MONOCHROME2.

Note

1. It is recommended that the Icon Images be encoding using VR OB encoding. The use of OW, allowed by the STD-XABC-CD Basic Cardiac profile defined in Annex A, is deprecated, and may be retired in future editions of the Standard.

2. This icon size is larger than that recommended in PS3.10 because the 64x64 icon would not be clinically useful for identifying and selecting X-Ray angiographic images.

3. For Multi-frame Images, it is recommended that the icon image be derived from the frame identified in the Representative Frame Number attribute (0028,6010), if defined for the image SOP Instance. If the Representative Frame Number is not present, a frame approximately one-third of the way through the Multi-frame Image should be selected. The process to reduce any image to a 128x128 image is beyond the scope of this Standard.

B.3.4 Other Parameters

This section defines other parameters common to all specific Media Storage Application Profiles in the STD-XA1K class that need to be specified in order to ensure interoperable media interchange.

B.3.4.1 Image Attribute Values

The attributes listed in Table B.3-3 used within the X-Ray Angiographic Image files have the specified values.

Table B.3-3. STD-XA1K Required XA Image Attribute Values

Attribute	Tag	Value
Modality	(0008,0060)	XA
Rows	(0028,0010)	up to 1024 (see below)
Columns	(0028,0011)	up to 1024 (see below)
Bits Stored	(0028,0101)	8, 10, and 12 bits only

Note

1. An FSC or FSU, when creating or updating a File-set, Rows or Columns will not exceed a value of 1024. When reading a File-set, an FSR or FSU will accept all values of up to 1024 for Rows or Columns.

2. Photometric Interpretation, Pixel Representation, High Bit, Bits Allocated and Samples per Pixel are defined in the XA IOD.

The attributes listed in Table B.3-4 used within the Secondary Capture Image files have the specified values.

Table B.3-4. STD-XA1K Required SC Image Attribute Values

Attribute	Tag	Value
Rows	(0028,0010)	up to 1024 (see below)
Columns	(0028,0011)	up to 1024 (see below)
Samples per Pixel	(0028,0002)	1
Photometric Interpretation	(0028,0004)	MONOCHROME2
Bits Allocated	(0028,0100)	8 bits only
Bits Stored	(0028,0101)	8 bits only
High Bit	(0028,0102)	7
Pixel Representation	(0028,0103)	0000H (unsigned)

Note

1. An FSC or FSU, when creating or updating a File-set, Rows or Columns will not exceed a value of 1024. When reading a File-set, an FSR or FSU will accept all values of up to 1024 for Rows or Columns.

2. It is recommend that Referenced Image Sequence (0008,1140) be present if the SC Image is significantly related to XA images and frames stored on the same media, and if present, it should contain references to those images and frames.

Overlay Group 60XX shall not be present in Secondary Capture Images, and Standalone Overlays shall not be referenced by or to Secondary Capture Images used in this profile.

B.3.4.2 Multi-frame JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

B.3.4.3 Attribute Value Precedence

Retired.

C Ultrasound Media Storage Application Profile (Normative)

C.1 Class and Profile Identification

This Annex defines Media Storage Application Profiles for Ultrasound Media Storage applications. Each Media Storage Application Profile has a unique identifier used for conformance claims. Due to the variety of clinical applications of storage media in Ultrasound, a family of Media Storage Application Profiles are described in this section to best tailor an application choice to the specific needs of the user. The identifier used to describe each profile is broken down into three parts: a prefix, mid-section, and suffix. The prefix describes the overall Media Storage Application Profile Class and is common for all ultrasound Media Storage Application Profiles. The mid section describes the specific clinical application of the profile. The suffix is used to describe the actual media choice the profile will use.

The prefix for this class of Media Storage Application Profiles is identified with the STD-US identifier.

Note

Conformance Statements may use the earlier prefix of APL that is equivalent to STD. This use is deprecated and may be retired in future editions of the Standard.

The midsection is broken down into three subclasses that describe the clinical use of the data. These subclasses are: Image Display (ID identifier), Spatial Calibration (SC identifier), and Combined Calibration (CC identifier). All three subclasses can be applied to either single frames (SF) images or single and multi-frames (MF) images. The SC subclass enhances the ID class by adding the requirement for region specific spatial calibration data with each IOD. The CC subclass enhances the SC subclass by requiring region specific pixel component calibration.

The suffix, xxxx, is used to describe the actual media choice used for the conformance claim. Any of the above mentioned classes can be stored onto one of eight pieces of media described in the Table C.3-3.

The specific Media Storage Application Profiles are shown in the following table.

Table C.1-1. Ultrasound Media Storage Application Profile identifiers

Media Storage Application Profile	Single Frame	Single & Multi-Frame
Image Display	STD-US-ID-SF-xxxx	STD-US-ID-MF-xxxx
Spatial Calibration	STD-US-SC-SF-xxxx	STD-US-SC-MF-xxxx
Combined Calibration	STD-US-CC-SF-xxxx	STD-US-CC-MF-xxxx

The ID Media Storage Application Profile Classes are intended to be used for the transfer of ultrasound images for display purposes.

The SC Media Storage Application Profile Classes are intended to be used for the transfer of ultrasound images with spatial calibration data for quantitative purposes (see Section C.4).

The CC Media Storage Application Profile Classes are intended to be used for the transfer of ultrasound images with spatial and pixel component calibration data for more advanced quantitative purposes (see Section C.5).

C.2 Clinical Context

These classes of Media Storage Application Profiles facilitate the interchange of ultrasound data on media. Typical interchanges would be between ultrasound systems, between an ultrasound system and a display workstation, between display workstations, or between an ultrasound system and a data archive. This context is shown in Figure C.2-1.

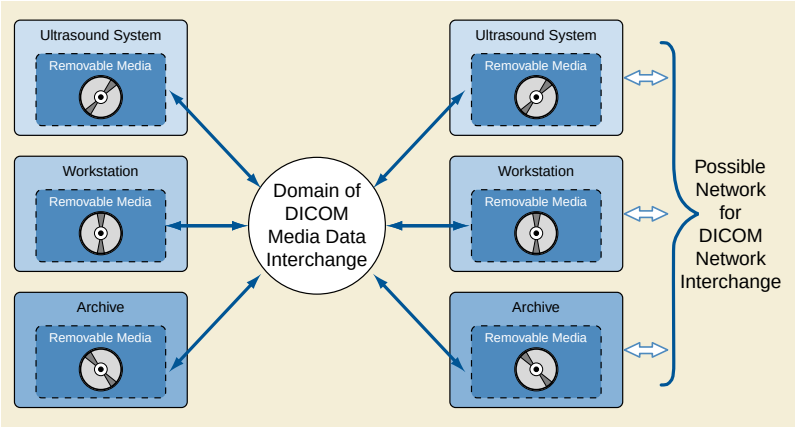

Figure C.2-1. Ultrasound Clinical Context

The operational use of the media transfer is potentially both intra-institutional and inter-institutional.

C.2.1 Roles

C.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under the STD-US class of Media Storage Application Profiles. Typical entities using this role would include ultrasound imaging equipment, workstations, and archive systems that generate a patient record for transfer. File-set Creators shall be able to generate the DICOMDIR directory file, single and/or multi frame Ultrasound Information Object files, and depending on the subclass, region specific calibration in the defined Transfer Syntaxes.

An FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc) or to allow packet-writing, if supported by the media and file system specified in the profile.

C.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set. Typical entities using this role would include ultrasound systems, display workstations, and archive systems that receive a patient record from a piece of media. File-set Readers shall be able to read the DICOMDIR directory file and all Information Objects defined for the specific Media Storage Application Profiles, using the defined Transfer Syntaxes.

C.2.1.3 File-set Updater

The role of File-set Updater shall be used by Application Entities that receive a transferred File-set and updates it by the addition or deletion of objects to the media. Typical entities using this role would include ultrasound systems adding new patient records to the media and workstations that may add an information object containing a processed or modified image.

An FSU shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc) or to allow packet-writing, if supported by the media and file system specified in the profile.

The FSU role is not defined for the STD-US-xx-xx-DVD profiles (i.e., for DVD media that is not DVD-RAM).

C.3 General Class Profile

C.3.1 SOP Classes and Transfer Syntaxes

Media Storage Application Profiles in this class, STD-US, shall support the appropriate Information Object Definitions (IODs) and Transfer Syntaxes in the following table. In the role of FSU or FSC the application can choose one of the three possible Transfer

Syntaxes to create a SOP Instance. In the role of FSR an application shall support all Transfer Syntaxes defined for the respective STD-US Media Storage Application Profile.

Table C.3-1. Ultrasound SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	RLE Lossless	1.2.840.10008.1.2.5
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	RLE Lossless	1.2.840.10008.1.2.5
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

C.3.1.1 Ultrasound Single and Multi-frame Pixel Formats Supported

The Media Storage Application Profiles of the STD-US class require that all ultrasound image objects only be stored using the values described in the US Image Module in PS3.3 and the specializations used for the Ultrasound Single and Multi-Frame IODs.

In the role of FSU or FSC the application can choose any of the supported Photometric Interpretations described in the US Image Module in PS3.3 to create an IOD. In the role of FSR, an application shall support all Photometric Interpretations described in the US Image Module in PS3.3.

Table C.3-2 describes restrictions on the use of various Transfer Syntaxes with the supported Photometric Interpretations for both single and Multi-frame Images.

Table C.3-2. Defined Photometric Interpretation and Transfer Syntax Pairs

Photometric Interpretation Value	Transfer Syntax	Transfer Syntax UID
MONOCHROME2	Explicit VR Little Endian	1.2.840.10008.1.2.1
	RLE Lossless	1.2.840.10008.1.2.5
RGB	Explicit VR Little Endian	1.2.840.10008.1.2.1
	RLE Lossless	1.2.840.10008.1.2.5
PALETTE COLOR	Explicit VR Little Endian	1.2.840.10008.1.2.1
	RLE Lossless	1.2.840.10008.1.2.5
YBR_FULL	RLE Lossless	1.2.840.10008.1.2.5
YBR_FULL_422	Explicit VR Little Endian	1.2.840.10008.1.2.1
	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50

C.3.2 Physical Media and Media Formats

An ultrasound Media Storage Application Profile class may be supported by any one of the media described in Table C.3-3.

Table C.3-3. Media Classes

Media	Media Classes	Media Format	PS3.12
2.3GB 90mm MOD	MOD23-90	DOS, unpartitioned (removable media)	Annex Q “90 mm 2.3 GB Magneto-Optical Disk (Normative)”
CD-R	CDR	ISO/IEC 9660	Annex F “120mm CD-R Medium (Normative)”

Media	Media Classes	Media Format	PS3.12
DVD-RAM	DVD-RAM	UDF1.5	Annex J “UDF on 120 mm DVD-RAM Medium (Normative)”
120 mm DVD	DVD	UDF or ISO 9660	Annex P “120 mm DVD Medium (Normative)”

Note

Media Classes FLOP, MOD128, MOD230, MOD540, MOD640, MOD650, MOD12 AND MOD23 were previously defined but have been retired. See PS3.11 2004.

C.3.3 DICOMDIR

The Directory shall include Directory Records of PATIENT, STUDY, SERIES, IMAGE corresponding to the information object files in the File-set. All DICOM files in the File-set incorporating SOP Instances (Information Objects) defined for the specific Media Storage Application Profile shall be referenced by Directory Records. At the image level each file contains a single ultrasound image object or a single ultrasound Multi-frame Image object as defined in PS3.3 of the Standard.

Note

For all media selected in this Media Storage Application Profile Class, STD-US, the following applies as defined in PS3.12.

All implementations should include the DICOM Media Storage Directory in the DICOMDIR file. There should only be one DICOMDIR file on a single media. The DICOMDIR file should be found in the root directory of the media. For the case of double-sided MOD media, there shall be a DICOMDIR on each side of the media.

On a single media the patient ID key at the patient level shall be unique for each patient directory record.

C.3.3.1 Additional Keys

File-set Creators and File-set Updaters are only required to generate required Attributes specified in PS3.10. At each directory record level any additional Data Elements can be added as keys, but is not required by File-set Readers to be able to use them as keys.

C.3.3.2 File Component IDs

Note

File Component IDs should be created using a random number filename to minimize File Component ID collisions as described in PS3.12. The FSU should check the existence of a Component ID prior to creating that ID. Should an ID collision occur, the FSU should try another ID.

C.4 Spatial Calibration (SC) Class Requirements

All implementations conforming to the Media Storage Application Profile Class SC shall include the US Region Calibration Module with the exception of Pixel Component Organization (0018,6044) and other Attributes that are conditional on that Attribute.

C.5 Combined Calibration (CC) Class Requirements

All implementations conforming to the Media Storage Application Profile Class CC shall include the US Region Calibration Module including Pixel Component Organization (0018,6044) and other Attributes that are conditional on that Attribute.

D General Purpose CD-R, DVD and BD Interchange Profiles (Normative)

D.1 Profile Identification

This Annex defines a Media Storage Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via CD-R, DVD-RAM and BD media for general purpose applications. Objects from multiple modalities may be included on the same media.

A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table D.1-1. STD-GEN Profile

Media Storage Application Profile	Identifier	Description
General Purpose CD-R Interchange	STD-GEN-CD	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms.
General Purpose Interchange on DVD-RAM Media	STD-GEN-DVD-RAM	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms.
General Purpose Secure CD-R Interchange	STD-GEN-SEC-CD	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure Interchange on DVD-RAM Media	STD-GEN-SEC-DVD-RAM	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Interchange on BD Media	STD-GEN-BD	Handles Interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms.
General Purpose Secure Interchange on BD Media	STD-GEN-SEC-BD	Handles Interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

The identifier for this General Purpose Image Exchange profile class shall be STD-GEN.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

D.2 Clinical Context

This Media Storage Application Profile facilitates the interchange of images and related data on CD-R, DVD-RAM and BD media. Typical interchange would be between acquisition devices, archives and workstations.

This Media Storage Application Profile facilitates the creation of a multi-modality medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

This profile is intended only for general purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context. The latter may support compression Transfer Syntaxes, limitations on

the form and content of SOP Class instances, and specific media choices that preclude the use of the General Purpose Interchange Profile.

Note

The creation of a CD, DVD-RAM or BD is considerably more complex than the reading thereof. Therefore the clinical context for this Media Storage Application Profile is likely to be asymmetric, with a sophisticated File-set Creator and relatively simple File-set Readers.

D.2.1 Roles and Service Class Options

This Media Storage Application Profile uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator (FSC), File-set Reader (FSR), and File-set Updater (FSU), defined in PS3.10.

D.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Image Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-GEN Media Storage Application Profile.

FSC shall offer the ability to either finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) or to allow multi-session (additional information may be subsequently added to the volume) or to allow packet-writing, if supported by the media and file system specified in the profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media), the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

D.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under the Image Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using the defined Transfer Syntax.

D.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set under the Image Exchange Class of Media Storage Application Profiles and update it by the addition (or deletion) of images or information to (or from) the medium. Typical entities using this role would include image generating systems and workstations that process or modify images.

File-set Updaters shall be able to generate one or more of the SOP Instances defined for this Media Storage Application Profile, for which a Conformance Statement is made, and to read and update the DICOMDIR file.

FSU shall offer the ability to either finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) or to allow multi-session (additional information may be subsequently added to the volume) or to allow packet-writing. if supported by the media and file system specified in the profile.

Note

If the volume has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the volume to write a new DICOMDIR file, the information, and the fundamental volume control structures. Volume control structures are the structures that are inherent to the standards of the physical volume, see PS3.12.

D.3 STD-GEN Profile Class

D.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class (see PS3.4).

Table D.3-1. STD-GEN-CD, STD-GEN-DVD-RAM, STD-GEN-SEC-CD, STD-GEN-SEC-DVD-RAM, STD-GEN-BD, STD-GEN-SEC-BD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Explicit VR Little Endian 1.2.840.10008.1.2.1	Defined in Conformance Statement	Defined in Conformance Statement	Optional

The SOP Classes and corresponding Transfer Syntax supported by these Media Storage Application Profiles are specified in the Table D.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

D.3.2 Physical Medium and Medium Format

The STD-GEN-CD and STD-GEN-SEC-CD Media Storage Application Profiles require the 120 mm CD-R physical medium with the ISO/IEC 9660 Media Format, as defined in PS3.12.

The STD-GEN-DVD-RAM and STD-GEN-SEC-DVD-RAM Media Storage Application Profiles require the 120 mm DVD-RAM medium, as defined in PS3.12.

The STD-GEN-BD and STD-GEN-SEC-BD Media Storage Application Profiles require any of the 120 mm BD media, as defined in PS3.12.

D.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

D.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table D.3-2 specifies the additional associated keys. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

Table D.3-2. STD-GEN Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Image Type	(0008,0008)	IMAGE	1C	Required if present in image object.
Referenced Image Sequence	(0008,1140)	IMAGE	1C	Required if present in image object.
>Referenced SOP Class UID	(0008,1150)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present
>Referenced SOP Instance UID	(0008,1155)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present.
>All other Attributes from Referenced Image Sequence (including Purpose of Reference Code Sequence and its content)		IMAGE	3	

Note

The requirements with respect to the mandatory DICOMDIR keys in PS3.3 imply that either these attributes are present in the Image IOD, or they are in some other way supplied by the File-set Creator. These attributes are (0010,0020) Patient ID, (0008,0020) Study Date, (0008,0030) Study Time, (0020,0010) Study ID, (0020,0011) Series Number, and (0020,0013) Instance Number.

D.3.3.2 Attribute Value Precedence

Retired. See PS3.11 2004.

Note

The retired Detached Patient Management SOP Class was previously suggested to allow patient identification and demographic information to be updated without changing the composite Image IOD files. This usage is now retired.

D.3.4 Other Parameters

Not applicable.

D.3.5 Security Parameters

The STD-GEN-SEC-CD, STD-GEN-SEC-DVD-RAM and STD-GEN-SEC-BD Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure Integrity or carry the same originators' signatures.

E CT and MR Image Media Storage Application Profiles (Normative)

E.1 Profile Identification

This Annex defines Media Storage Application Profiles for Computed Tomography and Magnetic Resonance Imaging interchange and storage on high capacity rewritable magneto-optical disks (MOD) and CD-R and DVD-RAM and other DVD media uncompressed and with lossless compression.

Table E.1-1. STD-CTMR Profiles

Media Storage Application Profile	Identifier	Description
CT/MR Studies on 4.1GB MOD	STD-CTMR-MOD41	Handles single frame 8, 12 or 16 bit grayscale and 8 bit palette color, uncompressed and lossless compressed images.
CT/MR Studies on CD-R	STD-CTMR-CD	Handles single frame 8, 12 or 16 bit grayscale and 8 bit palette color, uncompressed and lossless compressed images.
CT/MR Studies on DVD-RAM Media	STD-CTMR-DVD-RAM	Handles single frame 8, 12 or 16 bit grayscale and 8 bit palette color, uncompressed and lossless compressed images.
CT/MR Studies on DVD Media	STD-CTMR-DVD	Handles single frame 8, 12 or 16 bit grayscale and 8 bit palette color, uncompressed and lossless compressed images.

Note

Media Profiles STD-CTMR-MOD650, STD-CTMR-MOD12 and STD-CTMR-MOD23 were previously defined but have been retired. See PS3.11 2004.

E.2 Clinical Context

These Media Storage Application Profiles facilitate the interchange and storage of primary CT and MR images as well as related Secondary Capture Images with certain defined attributes, including grayscale and palette color images. CT, MR and SC images may co-exist within the same File-set.

Typical interchanges would be between acquisition devices, archives and workstations, within and between institutions.

E.2.1 Roles and Service Class Options

These Media Storage Application Profiles uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator, File-set Reader, and File-set Updater, defined in PS3.10.

E.2.1.1 File-set Creator

The Application entity acting as a File-set Creator generates a File-set under a STD-CTMR Media Storage Application Profile. Typical entities using this role would include CT or MR equipment, and archive systems that generate a patient record for transfer to another institution. File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR File with all types of Directory Records related to the SOP Classes stored in the File-set.

An FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc) or to allow packet-writing, if supported by the media and file system specified in the profile.

Note

A multiple volume (a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume, the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

E.2.1.2 File-set Reader

The role of File-set Reader is used by Application Entities that receive a transferred File-set. Typical entities using this role would include display workstations, and archive systems that receive a patient record transferred from another institution. File-set Readers shall be able to read all the SOP Classes defined for the specific Media Storage Application Profile for which a Conformance Statement is made, using all the defined Transfer Syntaxes.

E.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set and update it by the addition of information. Typical entities using this role would include analytic workstations, which, for instance, may add to the File-set an information object containing a processed image. Stations that update patient information objects would also use this role. File-set Updaters do not have to read the images. File-set Updaters shall be able to generate one or more of the SOP Instances defined for the specific Media Storage Application Profile for which a conformance statement is made, and to read and update the DICOMDIR file.

An FSU shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc) or to allow packet-writing if supported by the media and file system specified in the profile.

Note

If the volume has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the volume to write a new DICOMDIR file, the information, and the fundamental volume control structures. Volume control structures are the structures that are inherent to the standards of the physical volume, see PS3.12.

The FSU role is not defined for the STD-CTMR-DVD profile.

E.3 STD-CTMR Profiles

E.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class (see PS3.4).

SOP Classes and corresponding Transfer Syntaxes supported by these Media Storage Application Profiles are specified in the Table E.3-1.

Table E.3-1. STD-CTMR SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement (see Note 1)
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
CT Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Optional	Mandatory	Optional

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement (see Note 1)
CT Image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory	Optional
MR Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Optional	Mandatory	Optional
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory	Optional
Secondary Capture Image (Grayscale)	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Optional	Mandatory	Optional
Secondary Capture Image (Grayscale)	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory	Optional
Secondary Capture Image (Palette Color)	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Optional	Optional	Optional
Secondary Capture Image (Palette Color)	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional	Optional
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional	Optional
X-Ray Radiation Dose SR	1.2.840.10008.5.1.4.1.1.88.67	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional	Optional

Note

1. The FSU requirement is not defined for the STD-CTMR-DVD profile.
2. The Detached Patient Management SOP Class was formerly defined in these profiles, but has been retired.

E.3.2 Physical Medium and Medium Format

The STD-CTMR-MOD41 Media Storage Application Profile requires the 130 mm 4.1GB R/W MOD physical medium with the PCDOS Media Format, as defined in PS3.12.

The STD-CTMR-CD Media Storage Application Profile requires the 120 mm CD-R physical medium with the ISO 9660 Media Format, as defined in PS3.12.

The STD-CTMR-DVD-RAM Media Storage Application Profile requires the 120 mm DVD-RAM medium, as defined in PS3.12.

The STD-CTMR-DVD Media Storage Application Profile requires any of the 120 mm DVD media other than DVD-RAM, as defined in PS3.12.

E.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File a Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set. All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

E.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in Annex F “Basic Directory IOD (Normative)” in PS3.3.

E.3.3.2 Localizer Related Attributes

Directory Records of type IMAGE shall include the mandatory attributes from the Frame of Reference and Image Plane modules, if present in the composite image object, as specified in PS3.3 and included in Table E.3-2, in order to allow the image to be referenced to a localizer image or other orthogonal image. The Rows (0028,0010) and Columns (0028,0011) attributes are required in order to facilitate annotation of such a localizer.

Note

The Frame of Reference module is specified in PS3.3 as mandatory for the CT and MR composite information objects, but not for Secondary Capture objects.

E.3.3.3 Icon Images

Directory Records of type SERIES or IMAGE may include Icon Images. The icon pixel data shall be as specified in PS3.3 Icon Image Key Definition, and restricted such that Photometric Interpretation (0028,0004) shall be MONOCHROME2 or PALETTE COLOR, Bits Allocated (0028,0100) and Bits Stored (0028,0101) shall be equal to 8, and Rows (0028,0010) and Columns (0028,0011) shall be equal to 64.

E.3.4 Other Parameters

This section defines other parameters in the STD-CTMR profiles that need to be specified in order to ensure interoperable information interchange.

Table E.3-2. STD-CTMR Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Referenced Image Sequence	(0008,1140)	IMAGE	1C	Required if present in image object.
>Referenced SOP Class UID	(0008,1150)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present.
>Referenced SOP Instance UID	(0008,1155)	IMAGE	1C	Required if Referenced Image Sequence (0008,1140) is present.
>All other Attributes from Referenced Image Sequence (including Purpose of Reference Code Sequence and its content)		IMAGE	3	
Image Position (Patient)	(0020,0032)	IMAGE	1C	Required if present in image object.
Image Orientation (Patient)	(0020,0037)	IMAGE	1C	Required if present in image object.
Frame of Reference UID	(0020,0052)	IMAGE	1C	Required if present in image object.
Rows	(0028,0010)	IMAGE	1	
Columns	(0028,0011)	IMAGE	1	

Key Attribute	Tag	Directory Record Type	Type	Notes
Pixel Spacing	(0028,0030)	IMAGE	1C	Required if present in image object.

Note

1. The Basic Directory Information Object definition in PS3.3 defines the following attributes as Type 1 or 2: for PATIENT directory records: (0010,0010) Patient's Name; for STUDY directory records: (0008,0050) Accession Number, (0008,0020) Study Date, (0008,1030) Study Description; for SERIES directory records: (0008,0060) Modality. Hence these are not redefined here.

2. The Basic Directory Information Object definition in PS3.3 allows for the optional inclusion of Icon Images at the IMAGE or SERIES level. These remain optional for this profile, and the choice of whether or not to include Icon Images for every image or series, or in a more selective manner, is left up to the implementer. E.3.3.3 describes restrictions that apply to Icon Images that are included in this profile.

E.3.4.1 Image Attribute Values

The attributes listed in Table E.3-3 used within CT Image files, those listed in Table E.3-4 used within MR Image files, those listed in Table E.3-5 used within grayscale SC Image files, and those listed in Table E.3-6 used within color SC Image files, shall take the values specified, which are more specific than, but must be consistent with, those specified in the definition of the CT, MR and SC Image Information Object Definitions in PS3.3.

Table E.3-3. STD-CTMR Required Image Attribute Values for CT Images

Attribute	Tag	Value
Modality	(0008,0060)	CT
Photometric Interpretation	(0028,0004)	MONOCHROME2

Table E.3-4. STD-CTMR Required Image Attribute Values for MR Images

Attribute	Tag	Value
Modality	(0008,0060)	MR
Photometric Interpretation	(0028,0004)	MONOCHROME2
Bits Stored	(0028,0101)	8, 12 to 16
High Bit	(0028,0102)	Bits Stored (0028,0101) - 1

Note

The definition of the MR Composite Image Object in PS3.3 does not restrict (0028,0101) Bits Stored or (0028,0102) High Bit.

Table E.3-5. STD-CTMR Required Image Attribute Values for Grayscale SC Images

Attribute	Tag	Value
Samples Per Pixel	(0028,0002)	1
Photometric Interpretation	(0028,0004)	MONOCHROME2
Bits Allocated	(0028,0100)	8 or 16
Bits Stored	(0028,0101)	Bits Allocated (0028,0100)
High Bit	(0028,0102)	Bits Stored (0028,0101) - 1

Table E.3-6. STD-CTMR Required Image Attribute Values for Color SC Images

Attribute	Tag	Value
Samples Per Pixel	(0028,0002)	1
Photometric Interpretation	(0028,0004)	PALETTE COLOR
Bits Allocated	(0028,0100)	8
Bits Stored	(0028,0101)	8
High Bit	(0028,0102)	7

E.3.4.1.1 Attribute Value Precedence

Retired.

F Waveform Diskette Interchange Profile (Normative)

Retired. See PS3.11 2004.

G General Purpose MIME Interchange Profile (Normative)

G.1 Profile Identification

This Annex defines a Media Storage Application Profile Class including all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via e-mail for general purpose applications.

Note

This Media Storage Application Profile Class is not intended to replace the more robust DICOM Storage Service Class.

Objects from multiple modalities may be included on the same e-mail. A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table G.1-1. STD-GEN-MIME Profile

Media Storage Application Profile	Identifier	Description
General Purpose MIME Interchange	STD-GEN-MIME	Handles interchange of Composite SOP Instances by e-mail.

The identifier for this General Purpose MIME Interchange profile shall be STD-GEN-MIME.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

G.2 Clinical Context

This Media Storage Application Profile facilitates the interchange of images and related data through e-mail.

This profile is intended only for general purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context.

Note

The present Media Storage Application Profile does not include any specific mechanism regarding privacy. However it is highly recommended to use secure mechanisms (e.g., S/MIME) when using STD-GEN-MIME Media Storage Application Profile over networks that are not otherwise secured.

G.2.1 Roles and Service Class Options

This Media Storage Application Profile uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or two of the roles of File-set Creator (FSC) and File-set Reader (FSR), defined in PS3.10. Because the exchange of e-mail does not involve storage, the role of File-set Updater (FSU) is not specified.

G.2.1.1 File-set Creator

The role of File-set Creator may be used by Application Entities that generate a File-set under this Interchange Class of Media Storage Application Profiles.

File-set Creators may be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes included in the File-set.

The Application Entity acting as a File-set Creator generates a File-set under the STD-GEN-MIME Media Storage Application Profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple media) is not supported by this class of Media Storage Application Profile. Because MIME is a virtual medium and since e-mail mechanisms include some way of fragmenting MIME parts to be sent through limited size e-mail, there are no needs for multiple volume.

G.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive an exchanged File-set under the Image Interchange Class of Media Storage Application Profiles.

File-set Readers may be able to read the DICOMDIR directory file and shall be able to read all the SOP Instance files defined for this Media Storage Application Profile, using the Transfer Syntaxes specified in the Conformance Statement.

G.3 STD-GEN-MIME Profile

G.3.1 SOP Classes and Transfer Syntaxes

This Media Storage Application Profile is based on the Media Storage Service Class (see PS3.4).

Table G.3-1. STD-GEN-MIME SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Defined in Conformance Statement	Defined in Conformance Statement	Defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntaxes supported by this Media Storage Application Profile are specified in the Table G.3-1. The supported Storage SOP Class(es) and Transfers Syntax(es) shall be listed in the Conformance Statement.

G.3.2 Physical Medium and Medium Format

The STD-GEN-MIME Media Storage Application Profile requires the DICOM MIME medium as defined in PS3.12.

G.3.3 Directory Information in DICOMDIR

If the DICOMDIR is included, conformant Application Entities shall include in it the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

1. DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.
2. In the DICOMDIR each object may be referenced by a referenced file ID (e.g., 000/000) that contains multiple values corresponding to a path for physical system, since the MIME organization is flat. There is no requirement that this path will be used by the receiving application to create file hierarchy.

There may only be one DICOMDIR file per File-set. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

G.3.3.1 Additional Keys

No additional keys are specified.

H General Purpose DVD With Compression Interchange Profiles (Normative)

H.1 Profile Identification

This Annex defines a Media Storage Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via DVD media for general purpose applications. Objects from multiple modalities may be included on the same media. Images may be compressed with or without loss using either JPEG or JPEG 2000; all File-set Readers are required to support decompression of all of the compressed Transfer Syntaxes defined for each Profile.

A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table H.1-1. STD-GEN-DVD and STD-GEN-SEC-DVD Profiles

Media Storage Application Profile	Identifier	Description
General Purpose DVD Interchange with JPEG	STD-GEN-DVD-JPEG	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms, either uncompressed or with lossless or lossy JPEG.
General Purpose DVD Interchange with JPEG 2000	STD-GEN-DVD-J2K	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms, either uncompressed or with lossless or lossy JPEG 2000.
General Purpose Secure DVD Interchange with JPEG	STD-GEN-SEC-DVD-JPEG	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms, either uncompressed or with lossless or lossy JPEG. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure DVD Interchange with JPEG 2000	STD-GEN-SEC-DVD-J2K	Handles interchange of Composite SOP Instances such as Images, Structured Reports, Presentation States and Waveforms, either uncompressed or with lossless or lossy JPEG 2000. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

H.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of images and related data on DVD media. Typical interchange would be between acquisition devices, archives and workstations.

This Media Storage Application Profile Class facilitates the creation of a multi-modality medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

This profile is intended only for general purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context.

Note

The creation of a DVD is considerably more complex than the reading thereof. Therefore the clinical context for this Media Storage Application Profile is likely to be asymmetric, with a sophisticated File-set Creator and relatively simple File-set Readers.

H.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator (FSC) or File-set Reader (FSR), defined in PS3.10. The File-set Updater (FSU) role is not defined.

H.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Image Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-GEN-DVD or STD-GEN-SEC-DVD Media Storage Application Profile.

FSC shall offer the ability to either finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) or to allow multi-session (additional information may be subsequently added to the volume). An FSC may allow packet-writing, if supported by the media and file system specified in the profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media), the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

H.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under the Image Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using all the defined Transfer Syntaxes for the Profile.

Note

All Transfer Syntaxes defined in the profile must be supported by the FSR. It is not permissible to only support one or other of the uncompressed or the compressed Transfer Syntaxes.

H.2.1.3 File-set Updater

The FSU role is not defined for the STD-GEN-DVD and STD-GEN-SEC-DVD profiles.

H.3 STD-GEN-DVD and STD-GEN-SEC-DVD Profile Classes

H.3.1 SOP Classes and Transfer Syntaxes

This Media Storage Application Profile is based on the Media Storage Service Class (see PS3.4).

Table H.3-1. STD-GEN-DVD and STD-GEN-SEC-DVD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Explicit VR Little Endian 1.2.840.10008.1.2.1	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Defined in Conformance Statement	Mandatory for -JPEG profiles for all SOP Classes defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Baseline (Process 1) 1.2.840.10008.1.2.4.50	Defined in Conformance Statement	Mandatory for -JPEG profiles for all SOP Classes defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Extended (Process 2 & 4) 1.2.840.10008.1.2.4.51	Defined in Conformance Statement	Mandatory for -JPEG profiles for all SOP Classes defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression (Lossless Only) 1.2.840.10008.1.2.4.90	Defined in Conformance Statement	Mandatory for -J2K profiles for all SOP Classes defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression 1.2.840.10008.1.2.4.91	Defined in Conformance Statement	Mandatory for -J2K profiles for all SOP Classes defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntaxes supported by these Media Storage Application Profiles are specified in the Table H.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

H.3.2 Physical Medium and Medium Format

The STD-GEN-DVD and STD-GEN-SEC-DVD Media Storage Application Profiles require any of the 120 mm DVD media other than DVD-RAM, as defined in PS3.12.

H.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

H.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table H.3-2 specifies the additional associated keys. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

Table H.3-2. STD-GEN-DVD and STD-GEN-SEC-DVD Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Patient's Birth Date	(0010,0030)	PATIENT	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Patient's Sex	(0010,0040)	PATIENT	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Institution Name	(0008,0080)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Institution Address	(0008,0081)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Performing Physicians' Name	(0008,1050)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Image Type	(0008,0008)	IMAGE	1C	Required if present in image object.
Calibration Image	(0050,0004)	IMAGE	1C	Required if present in image object with a non-zero length value.
Referenced Image Sequence	(0008,1140)	IMAGE or SPECTROSCOPY	1C	Required if present in image object with one or more items, either in the top level Data Set or nested within a functional group sequence of the Shared Functional Groups Sequence (5200,9229). This sequence shall be the entire contents of the sequence present in image object (all items and Attributes shall be copied in the same order and no addition or removal shall be done). When more then one sequence is present in the image object, the top level Data Set sequence shall be copied.
Lossy Image Compression Ratio	(0028,2112)	IMAGE	1C	Required if present in image object with a non-zero length value.
Rows	(0028,0010)	IMAGE or SPECTROSCOPY	1	
Columns	(0028,0011)	IMAGE or SPECTROSCOPY	1	
Frame of Reference UID	(0020,0052)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object.
Synchronization Frame of Reference UID	(0020,0200)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object.
Number of Frames	(0028,0008)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object.
Acquisition Time Synchronized	(0018,1800)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object.
Acquisition DateTime	(0008,002A)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object.

Key Attribute	Tag	Directory Record Type	Type	Notes
Image Position (Patient)	(0020,0032)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object, either in the top level Data Set or nested within a functional group sequence of the Shared Functional Groups Sequence (5200,9229).
Image Orientation (Patient)	(0020,0037)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object, either in the top level Data Set or nested within a functional group sequence of the Shared Functional Groups Sequence (5200,9229).
Pixel Spacing	(0028,0030)	IMAGE or SPECTROSCOPY	1C	Required if present in image or spectroscopy object, either in the top level Data Set or nested within a functional group sequence of the Shared Functional Groups Sequence (5200,9229).

Note

The requirements with respect to the mandatory DICOMDIR keys in PS3.3 imply that either these attributes are present in the Image IOD, or they are in some other way supplied by the File-set Creator. These attributes are (0010,0020) Patient ID, (0008,0020) Study Date, (0008,0030) Study Time, (0020,0010) Study ID, (0020,0011) Series Number, and (0020,0013) Instance Number.

H.3.4 Other Parameters

H.3.4.1 Multi-frame JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

H.3.5 Security Parameters

The STD-GEN-SEC-DVD Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure Integrity or carry the same originators' signatures.

I DVD MPEG2 Interchange Profiles (Normative)

I.1 Profile Identification

This Annex defines a Media Storage Application Profile Class for all multi-frame Media Image Storage SOP Classes compressed with MPEG2.

Table I.1-1. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Profiles

Media Storage Application Profile	Identifier	Description
DVD Interchange with MPEG2 MP@ML	STD-DVD-MPEG2-MPML	Handles interchange of Multi-frame Images as MPEG2 MP@ML compressed video sequences.
Secure DVD Interchange with MPEG2 MP@ML	STD-DVD-SEC-MPEG2-MPML	Handles interchange of Multi-frame Images as MPEG2 MP@ML compressed video sequences. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

I.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of images data on DVD media. Typical interchange would be between acquisition devices, archives and workstations.

I.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator (FSC) or File-set Reader (FSR), defined in PS3.10. The File-set Updater (FSU) role is not defined.

I.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Image Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-DVD-MPEG2-MPML or STD-DVD-SEC-MPEG2-MPML Media Storage Application Profile.

FSC shall offer the ability to either finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) or to allow multi-session (additional information may be subsequently added to the volume). An FSC may allow packet-writing, if supported by the media and file system specified in the profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media), the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

I.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under the Image Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using all the defined Transfer Syntaxes for the Profile.

I.2.1.3 File-set Updater

The FSU role is not defined for the STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML profiles.

I.3 STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Profile Classes

I.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class (see PS3.4).

Table I.3-1. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG2 Main Profile / Main Level 1.2.840.10008.1.2.4.100	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntax supported by these Media Storage Application Profiles are specified in the Table I.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

I.3.2 Physical Medium and Medium Format

The STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Media Storage Application Profiles require any of the 120 mm DVD media other than DVD-RAM, as defined in PS3.12.

I.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

I.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table I.3-2 specifies the additional associated keys. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

Table I.3-2. STD-DVD-MPEG2-MPML and STD-DVD-SEC-MPEG2-MPML Additional DICOMDIR Keys

Key Attribute	Tag	Directory Record Type	Type	Notes
Patient's Birth Date	(0010,0030)	PATIENT	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Patient's Sex	(0010,0040)	PATIENT	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Institution Name	(0008,0080)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Institution Address	(0008,0081)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Performing Physicians' Name	(0008,1050)	SERIES	1C	Required if present in any objects referenced by subordinate records with a non-zero length value.
Image Type	(0008,0008)	IMAGE	1C	Required if present in image object.
Lossy Image Compression Ratio	(0028,2112)	IMAGE	1C	Required if present in image object with a non-zero length value.
Rows	(0028,0010)	IMAGE	1	
Columns	(0028,0011)	IMAGE	1	

Note

The requirements with respect to the mandatory DICOMDIR keys in PS3.3 imply that either these attributes are present in the Image IOD, or they are in some other way supplied by the File-set Creator. These attributes are (0010,0020) Patient ID, (0008,0020) Study Date, (0008,0030) Study Time, (0020,0010) Study ID, (0020,0011) Series Number, and (0020,0013) Instance Number.

I.3.4 Security Parameters

The STD-DVD-SEC-MPEG2-MPML Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure Integrity or carry the same originators' signatures.

I.3.5 "dual-format" (informative)

It is desirable that consumer DVD players (and computer software for playing conventional DVD movies) be able to play the video data that is encoded on the DICOM DVD. The MPEG2 bit stream that is "encapsulated" by the DICOM Transfer Syntax is potentially re-usable by such applications, if the appropriate UDF structure is created to share the same extent between the DICOM file and the file format and folder structure used by the consumer DVD Video format. Alternatively, the bit stream could be duplicated and both sets of files present on the same piece of media.

This profile does not require this, nor specify which approach to take. Specifically, this profile does not require that a DVD Video file and folder structure be present, though it is recommended.

J General Purpose USB and Flash Memory With Compression Interchange Profiles (Normative)

J.1 Profile Identification

This Annex defines a Media Storage Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via USB, CF, MMC or SD media for general-purpose applications. Objects from multiple modalities may be included on the same media. Images may be compressed with or without loss using either JPEG or JPEG 2000; all File-set Readers are required to support decompression of all of the compressed Transfer Syntaxes defined for each Profile.

A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table J.1-1. STD-GEN-USB, STD-GEN-SEC-USB STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD Profiles

Media Storage Application Profile	Identifier	Description
General Purpose USB Media Interchange with JPEG	STD-GEN-USB-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms.
General Purpose USB Media Interchange with JPEG-2000	STD-GEN-USB-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms.
General Purpose Secure USB Media Interchange with JPEG	STD-GEN-SEC-USB-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure USB Media Interchange with JPEG-2000	STD-GEN-SEC-USB-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Multimedia Card Interchange with JPEG	STD-GEN-MMC-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms.
General Purpose Multimedia Card Interchange with JPEG-2000	STD-GEN-MMC-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms.
General Purpose Secure Multimedia Card Interchange with JPEG	STD-GEN-SEC-MMC-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure Multimedia Card Interchange with JPEG-2000	STD-GEN-SEC-MMC-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Media Storage Application Profile	Identifier	Description
General Purpose CompactFlash Interchange with JPEG	STD-GEN-CF-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms.
General Purpose CompactFlash Interchange with JPEG-2000	STD-GEN-CF-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms.
General Purpose Secure CompactFlash Interchange with JPEG	STD-GEN-SEC-CF-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure CompactFlash Interchange with JPEG-2000	STD-GEN-SEC-CF-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Digital Card Interchange with JPEG	STD-GEN-SD-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms.
General Purpose Digital Card Interchange with JPEG-2000	STD-GEN-SD-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms.
General Purpose Secure Digital Card Interchange with JPEG	STD-GEN-SEC-SD-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure Digital Card Interchange with JPEG-2000	STD-GEN-SEC-SD-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either reversible or irreversible JPEG 2000), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

J.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of images and related data on USB, CF, MMC or SD media. Typical interchange would be between acquisition devices, archives and workstations.

This Media Storage Application Profile Class facilitates the creation of a multi-modality medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

This profile is intended only for general-purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context.

J.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4.

The Application Entity shall support one or more of the roles of File-set Creator (FSC) or File-set Reader (FSR), or File-set Updater (FSU) defined in PS3.10.

J.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-GEN-USB, STD-GEN-SEC-USB STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD or STD-GEN-SEC-SD Media Storage Application Profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media), the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

J.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under this Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using all the defined Transfer Syntaxes for the Profile.

Note

All Transfer Syntaxes defined in the profile must be supported by the FSR. It is not permissible to only support one or other of the uncompressed or the compressed Transfer Syntaxes.

J.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set under this Interchange Class of Media Storage Application Profiles and update it by the addition (or deletion) of images or information to (or from) the medium. Typical entities using this role would include image generating systems and workstations that process or modify images.

File-set Updaters shall be able to generate one or more of the SOP Instances defined for this Media Storage Application Profile, for which a Conformance Statement is made, and to read and update the DICOMDIR file.

J.3 STD-GEN-USB, STD-GEN-SEC-USB, STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD Profile Classes

J.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class (see PS3.4).

Table J.3-1. STD-GEN-USB, STD-GEN-SEC-USB, STD-GEN-MMC, STD-GEN-SEC-MMC, STD-GEN-CF, STD-GEN-SEC-CF, STD-GEN-SD and STD-GEN-SEC-SD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Explicit VR Little Endian 1.2.840.10008.1.2.1	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Baseline (Process 1) 1.2.840.10008.1.2.4.50	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Extended (Process 2 & 4) 1.2.840.10008.1.2.4.51	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression (Lossless Only) 1.2.840.10008.1.2.4.90	Defined in Conformance Statement	Mandatory for J2K profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression 1.2.840.10008.1.2.4.91	Defined in Conformance Statement	Mandatory for J2K profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntaxes supported by these Media Storage Application Profiles are specified in the Table J.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

J.3.2 Physical Medium and Medium Format

The STD-GEN-USB-JPEG, STD-GEN-SEC-USB-JPEG, STD-GEN-USB-J2K and STD-GEN-SEC-USB-J2K Media Storage Application Profiles require any of the USB Connected Removable Devices, as defined in PS3.12.

The STD-GEN-MMC-JPEG, STD-GEN-SEC-MMC-JPEG, STD-GEN-MMC-J2K and STD-GEN-SEC-MMC-J2K Media Storage Application Profiles require any of the Multimedia Card Removable Devices, as defined in PS3.12.

The STD-GEN-CF-JPEG, STD- GEN-SEC-CF-JPEG, STD-GEN-CF-J2K and STD-GEN-SEC-CF-J2K Media Storage Application Profiles require any of the CompactFlash Removable Devices, as defined in PS3.12.

The STD-GEN-SD-JPEG, STD-GEN-SEC-SD-JPEG, STD-GEN-SD-J2K and STD-GEN-SEC-SD-J2K Media Storage Application Profiles require any of the Secure Digital Card Removable Devices, as defined in PS3.12.

J.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

J.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table H.3-2 specifies the additional associated keys that shall also be applicable to the profiles defined in this Annex. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

J.3.4 Other Parameters

J.3.4.1 Multi-frame JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

J.3.5 Security Parameters

The STD-GEN-SEC-USB-JPEG, STD-GEN-SEC-MMC-JPEG, STD-GEN-SEC-CF-JPEG, STD-GEN-SEC-SD-JPEG, STD-GEN-SEC-USB-J2K, STD-GEN-SEC-MMC-J2K, STD-GEN-SEC-CF-J2K and STD-GEN-SEC-SD-J2K Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure Integrity or carry the same originators' signatures.

K Dental Media Storage Application Profile (Normative)

K.1 Class and Profile Identification

This Annex defines Media Storage Application Profiles for Dental Media Storage applications.

Table K.1-1. Dental Media Storage Application Profile identifiers

Media Storage Application Profile	Identifier	Description
Dental Radiograph Interchange	STD-DEN-CD	Interchange of dental radiographic images on CD

K.2 Clinical Context

This Media Storage Application Profile facilitates the interchange of dental data on media. Typical interchanges would be between dental systems, between a dental system and a display workstation, between display workstations, or between a dental system and a data archive. This context is shown in Figure K.2-1.

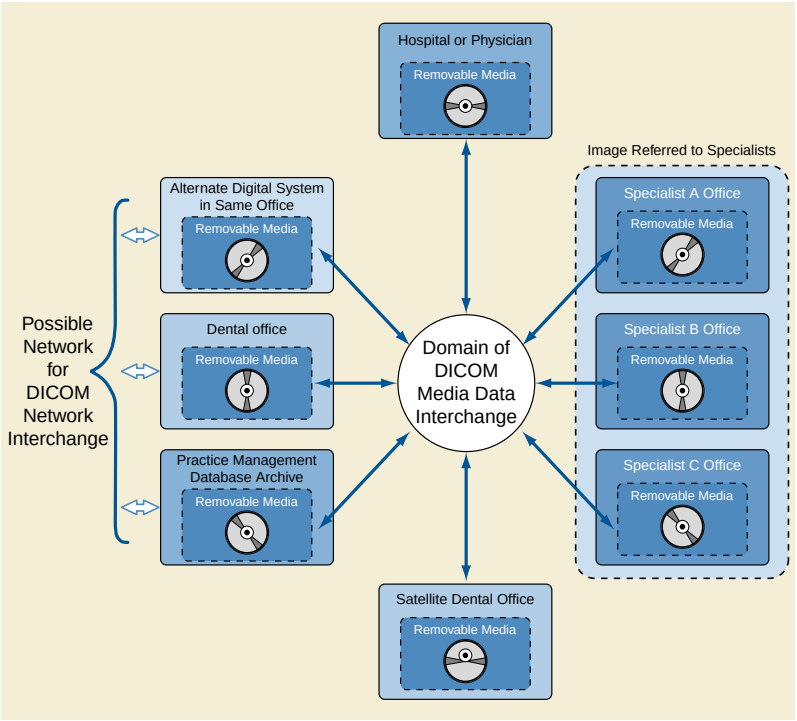

Figure K.2-1. Dental Clinical Context

The operational use of the media transfer is potentially between private practitioners and an institution, intra-institutional and inter-institutional.

K.2.1 Roles

K.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under the STD-DEN-CD Media Storage Application Profile. Typical entities using this role would include dental imaging equipment, workstations, and archive systems that generate a patient record for transfer. File-set Creators shall be able to generate the Basic Directory SOP Class Instance in the DICOMDIR file and Digital Intra-oral X-Ray and Digital X-Ray Image Storage SOP Class Instances in the File-set.

An FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

Note

A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Media Storage Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one CD-R, the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single CD-R media controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to indicate that there is more than one disc for this set of files (e.g., a study).

K.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set. Typical entities using this role would include dental systems, display workstations, and archive systems that receive a patient record from a piece of media. File-set Readers shall be able to read the DICOMDIR directory file and all SOP Class Instances defined for this Media Storage Application Profile, using the defined Transfer Syntaxes.

K.2.1.3 File-set Updater

The role of File-set Updater is not supported by this profile.

K.3 General Class Profile

K.3.1 SOP Classes and Transfer Syntaxes

The Media Storage Application Profile STD-DEN-CD shall support the SOP Classes and Transfer Syntaxes in the following table.

Table K.3-1. STD-DEN-CD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory
Basic Structured Display Storage	1.2.840.10008.5.1.4.1.1.131	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional
Grayscale Softcopy Presentation State	1.2.840.10008.5.1.4.1.1.11.1	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Optional

Note

The Digital X-Ray Image Storage and Digital Intra-oral X-Ray Image Storage - For Presentation SOP Classes can also be used for scanned film.

A File-set Creator shall support at least one of the specified image storage SOP Classes.

K.3.2 Physical Media and Media Formats

The STD-DEN-CD profile requires the 120 mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

K.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

No additional DICOMDIR keys are specified for this profile.

K.3.4 Other Parameters

K.3.4.1 Image Attribute Values

The Attributes listed in Table K.3-3 used within the image files shall take the values specified.

Table K.3-3. STD-DEN-CD - Required Image Attribute Values

Attribute	Tag	Value
Bits Allocated	(0028,0100)	If Bits Stored (0028,0101) is 8, then 8; otherwise 16.
Bits Stored	(0028,0101)	8, 10, 12 or 16

K.3.4.2 Image Attribute Specialization

The Attributes listed in Table K.3-4 shall have their Types specialized.

Table K.3-4. STD-DEN-CD - Required Image Attribute Types

Attribute	Tag	Type
Institution Name	(0008,0080)	2
Manufacturer's Model Name	(0008,1090)	2
Detector ID	(0018,700A)	2
Detector Manufacturer Name	(0018,702A)	2
Detector Manufacturer's Model Name	(0018,702B)	2

Note

These Type 3 attributes of the General Equipment and DX Detector Module are specialized in order to encourage FSCs to include values for them, recognizing that there are situations in which values may be unknown.

L ZIP File Over Email Interchange Profiles (Normative)

L.1 Profile Identification

This Annex defines three Media Storage Application Profiles for interchange of a DICOM Data Set, encapsulated in a ZIP File, through email.

Two Media Storage Application Profiles support all defined Media Storage SOP Classes. These are intended to be used for the interchange of Composite SOP Instances via email for general purpose applications. Objects from multiple modalities may be included on the same email. The email may also include non-DICOM objects. One of these general profiles supports encryption of the email.

A detailed list of the Media Storage SOP Classes is defined in PS3.4

The other Media Storage Application Profile is specialized for dental applications and adds mandatory requirements for dental images to the general secure email profile.

The specific Media Storage Application Profiles are shown in Table L.1-1:

Table L.1-1. STD-x-ZIP-MAIL Media Storage Application Profiles

Media Storage Application Profile	Identifier	Description
General Purpose ZIP Email	STD-GEN-ZIP-MAIL	Interchange of Composite SOP Instances by email.
General Purpose Secure ZIP Email	STD-GEN-SEC-ZIP-MAIL	Interchange of Composite SOP Instances by encrypted email.
Dental Radiograph ZIP Email	STD-DTL-SEC-ZIP-MAIL	Interchange of dental radiographic images by encrypted email

L.2 Clinical Context

These Media Storage Application Profiles facilitate the interchange of images and related data through email.

The STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL profiles are intended for general purpose applications. They are not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context. The STD-DTL-SEC-ZIP-MAIL profile is intended for the clinical context of the exchange of dental radiographs.

Note

It is possible to use email transport without using the encrypted secure profile. This would make sense for mailing DICOM objects that do not need protection.

L.2.1 Roles

L.2.1.1 File-set Creator

The role of File-set Creators shall be used by Application Entities that generate a File-set under any of the profiles listed in Table L.1-1. Typical entities that will use this role would include systems assigned to send images by email attachment to other systems. File-set Creators shall be able to generate the DICOMDIR directory file, and any supported DICOM Storage SOP Class Information Object files.

L.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set. File-set Readers shall be able to read the DICOMDIR directory file and all Information Objects defined for the specific Media Storage Application Profiles, using the defined Transfer Syntaxes.

L.2.1.3 File-set Updater

The role of File-set Updater is not defined for these Media Storage Application Profiles.

L.3 General Class Profile

L.3.1 STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes

Applications interchanging data under the STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL profiles shall support the Information Object Definitions (IOD) and Transfer Syntaxes for the Media Storage SOP Class specified in Table L.3-1.

Table L.3-1. STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Defined in Conformance Statement	Defined in Conformance Statement	Defined in Conformance Statement

Equipment claiming conformance to these Media Storage Application Profiles shall list the subset of Storage SOP Classes and Transfer Syntaxes that it supports in its Conformance Statement.

L.3.2 Medium Format

The STD-GEN-ZIP-MAIL and STD-GEN-SEC-ZIP-MAIL Media Storage Application Profiles shall use the ZIP File Media interchanged using the Email Media format as defined in PS3.12. This Email media shall comply with the following requirements:

a. The content shall be identified as: Content-Type: application/zip

b. The attachment shall be identified as: id="DICOM.ZIP"; name="DICOM.ZIP"

c. The disposition shall be: Content-Disposition: attachment; filename="DICOM.ZIP"

d. The email shall not be compressed.

e. The subject line shall contain the phrase:DICOM-ZIP

Note

An additional content type, file extension and file name may be defined by the Standard in the future to accommodate a DICOM specific zip file.

L.3.3 Directory Information in DICOMDIR

The Directory shall include Directory Records of PATIENT, STUDY, SERIES, IMAGE corresponding to the information object files in the File-set. All DICOM files in the File-set incorporating SOP Instances (Information Objects) defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by these Media Storage Application Profiles.

There may only be one DICOMDIR file per File-set. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

L.3.3.1 Additional Keys

No additional keys are specified.

L.3.4 Secure Transport

The Email Media interchange under the STD-GEN-SEC-ZIP-MAIL profile shall use the Secure Use of Email Transport profile specified in PS3.15.

L.4 Dental Class Profile

L.4.1 STD-DTL-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes

Applications interchanging data under the STD-DTL-SEC-ZIP-MAIL profile shall support the Information Object Definitions (IOD) and Transfer Syntaxes for the Media Storage SOP Class specified in Table L.3-2. File-set Creators for the STD-FTL-SEC-ZIP-MAIL shall support at least one of the optional IODs.

Table L.3-2. STD-DTL-SEC-ZIP-MAIL SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory
Digital Intra-oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian 1.2.840.10008.1.2.1	Optional	Mandatory

L.4.2 Medium Format

The STD-DTL-SEC-ZIP-MAIL Media Storage Application Profile shall use the ZIP File Media interchanged using the Email Media format as defined in PS3.12. This Email media shall comply with the following requirements:

a. The content shall be identified as: Content-Type: application/zip

b. The attachment shall be identified as: id="DICOM.ZIP"; name="DICOM.ZIP"

c. The disposition shall be: Content-Disposition: attachment; filename="DICOM.ZIP"

d. The email shall not be compressed.

e. The subject line shall contain the phrase:DICOM-ZIP

Note

An additional content type, file extension and file name may be defined by the Standard in the future to accommodate a DICOM specific zip file.

L.4.3 Directory Information in DICOMDIR

The Directory shall include Directory Records of PATIENT, STUDY, SERIES, IMAGE corresponding to the information object files in the File-set. All DICOM files in the File-set incorporating SOP Instances (Information Objects) defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by these Media Storage Application Profiles.

There may only be one DICOMDIR file per File-set. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

L.4.4.1 Additional Keys

No additional keys are specified.

L.4.5 Specific Image Requirements For STD-DTL-SEC-ZIP-MAIL

For Digital Intra-oral X-Ray Image and Digital X-Ray Image Instances interchanged under the STD-DTL-SEC-ZIP-MAIL profile, the Attributes listed in Table L.4-1 used within the image instances shall take the values specified.

Table L.4-1. STD-DTL-ZIP-MAIL - Required Image Attribute Values

Attribute	Tag	Value
Bits Allocated	(0028,0100)	If Bits Stored (0028,0101) is 8, then 8; otherwise 16.
Bits Stored	(0028,0101)	8, 10, 12 or 16

The Attributes listed in Table L.4-2 shall have their Types specialized.

Table L.4-2. STD-DTL-ZIP-MAIL - Required Image Attribute Types

Attribute	Tag	Type
Institution Name	(0008,0080)	2
Manufacturer's Model Name	(0008,1090)	2
Detector ID	(0018,700A)	2
Detector Manufacturer Name	(0018,702A)	2
Detector Manufacturer's Model Name	(0018,702B)	2

Note

These Type 3 attributes of the General Equipment and DX Detector Module are specialized in order to encourage FSCs to include values for them, recognizing that there are situations in which values may be unknown.

L.4.6 Secure Transport

The Email Media interchange under the STD-DTL-SEC-ZIP-MAIL profiles shall use the Secure Use of Email Transport profile specified in PS3.15.

M General Purpose BD With Compression Interchange Profiles (Normative)

M.1 Profile Identification

This Annex defines a Media Storage Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via BD media for general-purpose applications. Objects from multiple modalities may be included on the same media. Images may be compressed with or without loss using either JPEG or JPEG 2000. And Multi-frame Images and video may be compressed with MPEG2 Main Profile / Main Level or MPEG2 Main Profile / High Level or MPEG-4 AVC/H.264 High Profile / Level 4.1 or MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1; all File-set Readers are required to support decompression of all of the compressed Transfer Syntaxes defined for each Profile.

A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table M.1-1. STD-GEN-BD and STD-GEN-SEC-BD Profiles

Media Storage Application Profile	Identifier	Description
General Purpose BD Interchange with JPEG	STD-GEN-BD-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms.
General Purpose BD Interchange with JPEG 2000	STD-GEN-BD-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG 2000), Structured Reports, Presentation States and Waveforms.
General Purpose BD Interchange with MPEG2 MP@ML	STD-GEN-BD-MPEG2-MPML	Handles interchange of Multi-frame Images and video using MPEG2 MP@ML compression.
General Purpose BD Interchange with MPEG2 MP@HL	STD-GEN-BD-MPEG2-MPHL	Handles interchange of Multi-frame Images and video using MPEG2 MP@HL compression.
General Purpose BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.1	STD-GEN-BD-MPEG4-HPLV41	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.1 compression.
General Purpose BD Interchange with MPEG-4 AVC/H.264 BD-Compatible HiP@Level4.1	STD-GEN-BD-MPEG4-HPLV41BD	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 BD-compatible HiP@Level4.1 compression.
General Purpose Secure BD Interchange with JPEG	STD-GEN-SEC-BD-JPEG	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with JPEG 2000	STD-GEN-SEC-BD-J2K	Handles interchange of Composite SOP Instances such as Images (optionally compressed with either lossless or lossy JPEG 2000), Structured Reports, Presentation States and Waveforms. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with MPEG2 MP@ML	STD-GEN-SEC-BD-MPEG2-MPML	Handles interchange of Multi-frame Images and video using MPEG2 MP@ML compression. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Media Storage Application Profile	Identifier	Description
General Purpose Secure BD Interchange with MPEG2 MP@HL	STD-GEN-SEC-BD-MPEG2-MPHL	Handles interchange of Multi-frame Images and video using MPEG2 MP@HL compression. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.1	STD-GEN-SEC-BD-MPEG4-HPLV41	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.1 compression. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with MPEG-4 AVC/H.264 BD-compatible HiP@Level4.1	STD-GEN-SEC-BD-MPEG4-HPLV41BD	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 BD-compatible HiP@Level4.1 compression. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

M.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of images and related data on BD media. Typical interchange would be between acquisition devices, archives and workstations.

This Media Storage Application Profile Class facilitates the creation of a multi-modality medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

This profile is intended only for general-purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context.

Note

1. The creation of a BD is considerably more complex than the reading thereof. Therefore the clinical context for this Media Storage Application Profile is likely to be asymmetric, with a sophisticated File-set Creator and relatively simple File-set Readers.
2. Each BD Rewritable/Recordable contains a unique ID, which can be read by a BD drive. This ID can be used for referring to a BD, for example in a database.

M.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4 with the Interchange Option.

The Application Entity shall support one or more of the roles of File-set Creator (FSC) or File-set Reader (FSR), or File-set Updater (FSU) defined in PS3.10.

M.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-GEN-BD or STD-GEN-SEC-BD Media Storage Application Profile.

An FSC shall offer the ability to finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume), if supported by the media and file system specified in the profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media), the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

M.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under the Image Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using all the defined Transfer Syntaxes for the Profile.

Note

All Transfer Syntaxes defined in the profile must be supported by the FSR. It is not permissible to only support one or other of the uncompressed or the compressed Transfer Syntaxes.

M.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set under this Interchange Class of Media Storage Application Profiles and update it by the addition (or deletion) of images or information to (or from) the medium. Typical entities using this role would include image generating systems and workstations that process or modify images.

File-set Updaters shall be able to generate one or more of the SOP Instances defined for this Media Storage Application Profile, for which a Conformance Statement is made, and to read and update the DICOMDIR file.

An FSU shall offer the ability to finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume), if supported by the media and file system specified in the profile.

Note

If the volume has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the volume to write a new DICOMDIR file, the information, and the fundamental volume control structures. Volume control structures are the structures that are inherent to the standards of the physical volume, see PS3.12.

M.3 STD-GEN-BD and STD-GEN-SEC-BD Profile Classes

M.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class with the Interchange Option (see PS3.4).

Table M.3-1. STD-GEN-BD and STD-GEN-SEC-BD SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	Explicit VR Little Endian 1.2.840.10008.1.2.1	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1]) 1.2.840.10008.1.2.4.70	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Baseline (Process 1) 1.2.840.10008.1.2.4.50	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG Extended (Process 2 & 4) 1.2.840.10008.1.2.4.51	Defined in Conformance Statement	Mandatory for JPEG profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression (Lossless Only) 1.2.840.10008.1.2.4.90	Defined in Conformance Statement	Mandatory for J2K profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	JPEG 2000 Image Compression 1.2.840.10008.1.2.4.91	Defined in Conformance Statement	Mandatory for J2K profiles for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG2 Main Profile / Main Level 1.2.840.10008.1.2.4.100	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG2 Main Profile / High Level 1.2.840.10008.1.2.4.101	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG-4 AVC/H.264 High Profile / Level 4.1 1.2.840.10008.1.2.4.102	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1 1.2.840.10008.1.2.4.103	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntaxes supported by these Media Storage Application Profiles are specified in the Table M.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

M.3.2 Physical Medium and Medium Format

The STD-GEN-BD and STD-GEN-SEC-BD Media Storage Application Profiles require any of the 120 mm BD media, as defined in PS3.12.

M.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

M.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table H.3-2 specifies the additional associated keys that shall also be applicable to the profiles defined in this Annex. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

M.3.4 Other Parameters

M.3.4.1 Multi-frame JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

M.3.5 Security Parameters

The STD-GEN-SEC-BD Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure integrity or carry the same originators' signatures.

N General Purpose BD With MPEG-4 AVC/H.264 Level 4.2 Compression Interchange Profiles (Normative)

N.1 Profile Identification

This Annex defines a Media Storage Application Profile Class potentially inclusive of all defined Media Storage SOP Classes. This class is intended to be used for the interchange of Composite SOP Instances via BD media for general-purpose applications. Objects from multiple modalities may be included on the same media. Multi-frame Images and video may be compressed with MPEG-4 AVC/H.264 High Profile / Level 4.2 or MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2.

A detailed list of the Media Storage SOP Classes that may be supported is defined in PS3.4.

Table N.1-1. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Profiles

Media Storage Application Profile	Identifier	Description
General Purpose BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.2 for 2D video	STD-GEN-BD-MPEG4-HPLV42-2D	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.2 compression for 2D video.
General Purpose BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.2 for 3D video	STD-GEN-BD-MPEG4-HPLV42-3D	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.2 compression for 3D video.
General Purpose BD Interchange with MPEG-4 AVC/H.264 Stereo HiP@Level4.2	STD-GEN-BD-MPEG4-SHPLV42	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 Stereo High Profile / Level4.2 compression.
General Purpose Secure BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.2 for 2D video	STD-GEN-SEC-BD-MPEG4-HPLV42-2D	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.2 compression for 2D video. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.2 for 3D video	STD-GEN-SEC-BD-MPEG4-HPLV42-3D	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 HiP@Level4.2 compression for 3D video. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.
General Purpose Secure BD Interchange with MPEG-4 AVC/H.264 Stereo HiP @ Level4.2	STD-GEN-SEC-BD-MPEG4-SHPLV42	Handles interchange of Multi-frame Images and video using MPEG-4 AVC/H.264 Stereo High Profile / Level4.2 compression. Offers confidentiality, integrity and, depending on the File-set Creator's choice, data origin authentication.

Equipment claiming conformance to this Media Storage Application Profile shall list the subset of Media Storage SOP Classes that it supports in its Conformance Statement.

Note

Since it is not required to support all Media Storage Classes the user should carefully consider the subset of supported Media Storage SOP Classes in the Conformance Statements of such equipment to establish effective object interchange.

N.2 Clinical Context

This Media Storage Application Profile Class facilitates the interchange of images and related data on BD media. Typical interchange would be between acquisition devices, archives and workstations.

This Media Storage Application Profile Class facilitates the creation of a multi-modality medium for image interchange, useful for clinical, patient record, teaching and research applications, within and between institutions.

This profile is intended only for general-purpose applications. It is not intended as a replacement for specific Media Storage Application Profiles that may be defined for a particular clinical context.

Note

1. The creation of a BD is considerably more complex than the reading thereof. Therefore the clinical context for this Media Storage Application Profile is likely to be asymmetric, with a sophisticated File-set Creator and relatively simple File-set Readers.
2. Each BD Rewritable/Recordable contains a unique ID, which can be read by a BD drive. This ID can be used for referring to a BD, for example in a database.

N.2.1 Roles and Service Class Options

This Media Storage Application Profile Class uses the Media Storage Service Class defined in PS3.4 with the Interchange Option.

The Application Entity shall support one or more of the roles of File-set Creator (FSC) or File-set Reader (FSR) , or File-set Updater (FSU) defined in PS3.10.

N.2.1.1 File-set Creator

The role of File-set Creator shall be used by Application Entities that generate a File-set under this Interchange Class of Media Storage Application Profiles.

File-set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes stored in the File-set. The Application Entity acting as a File-set Creator generates a File-set under a STD-GEN-BD-MPEG4-LV42 or STD-GEN-SEC-BD-MPEG4-LV42 Media Storage Application Profile.

An FSC shall offer the ability to finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) , if supported by the media and file system specified in the profile.

Note

A multiple volume (i.e., a logical volume that can cross multiple physical media) is not supported by this class of Media Storage Application Profile. If a set of Files, e.g., a Study, cannot be written entirely on one physical volume (side of one piece of media) , the FSC will create multiple independent DICOM File-sets such that each File-set can reside on a single physical volume (side of a single piece of media) controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the physical volumes to indicate that there is more than one physical volume for this set of files (e.g., a study).

N.2.1.2 File-set Reader

The role of File-set Reader shall be used by Application Entities that receive a transferred File-set under the Image Interchange Class of Media Storage Application Profiles. Typical entities using this role would include image generating systems, display workstations, and archive systems that receive a patient record; e.g., transferred from another institution.

File-set Readers shall be able to read the DICOMDIR directory file and all the SOP Instance files defined for this Media Storage Application Profile, for which a Conformance Statement is made, using all the defined Transfer Syntaxes for the Profile.

Note

All Transfer Syntaxes defined in the profile must be supported by the FSR. It is not permissible to only support one or other of the uncompressed or the compressed Transfer Syntaxes.

N.2.1.3 File-set Updater

The role of File-set Updater is used by Application Entities that receive a transferred File-set under this Interchange Class of Media Storage Application Profiles and update it by the addition (or deletion) of images or information to (or from) the medium. Typical entities using this role would include image generating systems and workstations that process or modify images.

File-set Updaters shall be able to generate one or more of the SOP Instances defined for this Media Storage Application Profile, for which a Conformance Statement is made, and to read and update the DICOMDIR file.

An FSU shall offer the ability to finalize the physical volume at the completion of the most recent write session (no additional information can be subsequently added to the volume) , if supported by the media and file system specified in the profile.

Note

If the volume has not been finalized, the File-set Updater will be able to update information assuming there is enough space on the volume to write a new DICOMDIR file, the information, and the fundamental volume control structures. Volume control structures are the structures that are inherent to the standards of the physical volume, see PS3.12.

N.3 STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Profile Classes

N.3.1 SOP Classes and Transfer Syntaxes

These Media Storage Application Profiles are based on the Media Storage Service Class with the Interchange Option (see PS3.4).

Table N.3-1. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 SOP Classes and Transfer Syntaxes

Information Object Definition	SOP Class UID	Transfer Syntax Name and UID	FSC Requirement	FSR Requirement	FSU Requirement
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian 1.2.840.10008.1.2.1	Mandatory	Mandatory	Mandatory
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 2D Video 1.2.840.10008.1.2.4.104	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 3D Video 1.2.840.10008.1.2.4.105	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement
Multi-frame Composite IODs for which a Media Storage SOP Class is defined in PS3.4	*See PS3.4*	MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 1.2.840.10008.1.2.4.106	Defined in Conformance Statement	Mandatory for all SOP Classes defined in Conformance Statement	Defined in Conformance Statement

The SOP Classes and corresponding Transfer Syntaxes supported by these Media Storage Application Profiles are specified in the Table N.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement.

N.3.2 Physical Medium and Medium Format

The STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Media Storage Application Profiles require any of the 120 mm BD media, as defined in PS3.12.

N.3.3 Directory Information in DICOMDIR

Conformant Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and the subsidiary Study and Series levels, appropriate to the SOP Classes in the File-set.

All DICOM files in the File-set incorporating SOP Instances defined for the specific Media Storage Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this Media Storage Application Profile.

All implementations shall include the DICOM Media Storage Directory in the DICOMDIR file. There shall only be one DICOMDIR file per File-set. The DICOMDIR file shall be in the root directory of the medium. The Patient ID at the patient level shall be unique for each patient directory record in one File-set.

N.3.3.1 Additional Keys

File-set Creators and File-set Updaters are required to generate the required Attributes specified in PS3.3.

Table H.3-2 specifies the additional associated keys that shall also be applicable to the profiles defined in this Annex. At each directory record level other additional Data Elements can be added, but it is not required that File-set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS3.3.

N.3.4 Security Parameters

The STD-GEN-SEC-BD-MPEG4-LV42 Media Storage Application Profiles require that all DICOM Files in the File-set including the DICOMDIR be Secure DICOM Files encapsulated in accordance with the requirements of the Basic DICOM Media Security Profile as defined in PS3.15.

Note

These Media Storage Application Profiles do not place any consistency restrictions on the use of the Basic DICOM Media Security Profile with different DICOM Files of one File-set. For example, readers should not assume that all Files in the File-set can be decoded by the same set of recipients. Readers should also not assume that all secure Files use the same approach (hash key or digital signature) to ensure integrity or carry the same originators' signatures.