Digital Imaging and Communications in Medicine (DICOM)

Supplement 180:
MPEG-4 AVC/H.264 Transfer Syntax

DICOM Standards Committee, Working Group 13 Visible Light

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Table of Contents

Scope and Field of Application 3
Changes to NEMA Standards Publication PS 3.3 4
Changes to NEMA Standards Publication PS 3.5 8
Section 2 Normative references 9
8.2.X MPEG-4 AVC/H.264 High Profile / Level 4.2 Video Compression 10
8.2.Y MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 Video Compression 12
10.X TRANSFER SYNTAXES FOR MPEG-4 AVC/H.264 HIP@LEVEL4.2 IMAGE COMPRESSION 12
10.Y TRANSFER SYNTAX FOR MPEG-4 AVC/H.264 STEREO HIGH PROFILE / LEVEL 4.2 IMAGE COMPRESSION 12
Annex A (Normative) Transfer Syntax Specifications 13
A.4.X MPEG-4 AVC/H.264 HIP@LEVEL4.2 VIDEO COMPRESSION 13
Annex A (Normative) Transfer Syntax Specifications 13
A.4.Y MPEG-4 AVC/H.264 STEREO HIGH PROFILE /LEVEL 4.2 VIDEO COMPRESSION 13
Changes to NEMA Standards Publication PS 3.6 14
Changes to NEMA Standards Publication PS 3.11 16

Scope and Field of Application

This supplement describes three new Transfer Syntaxes to embed MPEG-4 Advanced Video Coding (AVC) / H.264 High Profile / Level 4.2 (HiP@Level4.2) and H.264 Stereo High Profile /Level 4.2 encoded pixel data in DICOM. It does not introduce any new SOP Classes or IODs.

Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 (HiP@Level4.2) for 2D Video will perform consistent with the ITU-T H.264 HiP@Level4.2 specifications except that the use of frame packing formats for 3D video is not allowed. This will enable the storage of video files with a resolution of 1920x1080 at 50Hz/60Hz.

Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 (HiP@Level4.2) for 3D Video will perform consistent with the ITU-T H.264 HiP@Level4.2 specifications. It should be used for transmitting stereoscopic 3D content with frame packing formats. This will enable the storage of 3D video files with a resolution of 1920x1080 at 50Hz/60Hz in frame packing format.

Transfer Syntax MPEG-4 AVC/H.264 Stereo High Profile /Level 4.2 will perform consistent with the ITU-T H.264 Stereo High Profile at Level 4.2. This will enable the storage of video files where higher compression can be achieved due to inter-view prediction. An example of the use would be in binocular operational microscopy.

This proposed supplement includes Addenda to existing Parts of DICOM:

- PS 3.5 Addendum: Data Structures and Encoding
- PS 3.6 Addendum: Data Dictionary
- PS 3.11 Addendum Media Storage Application Profiles

In the years since the DICOM Committee WG13 approved the new MPEG-4 AVC/H.264 Transfer Syntax with supplement 149, the capabilities of video recorders and video players have advanced considerably.

Support is required in DICOM for 2D and 3D video at 1080P 50/60 Hz as defined by MPEG-4 AVC / H.264 Level 4.2. Considerable space savings can be achieved when storing stereo recordings in Stereo High Profile format.
These three new transfer syntax will help to support advance technologies with an updated set of higher resolution, frame rates and compression capabilities.

Changes to NEMA Standards Publication PS 3.3

Digital Imaging and Communications in Medicine (DICOM)

Part 3: Information Object Definitions

Amend Multi-frame Module to include Stereoscopic Pair information:

C.7.6.6 Multi-frame Module

Table C.7-14 specifies the Attributes of a Multi-frame pixel data Image.

Table C.7-14. Multi-frame Module Attributes

Attribute Name	Tag	Type	Attribute Description
Number of Frames	(0028,0008)	1	Number of frames in a Multi-frame Image. See Section C.7.6.6.1.1 for further explanation.
Frame Increment Pointer	(0028,0009)	1	Contains the Data Element Tag of the attribute that is used as the frame increment in Multi-frame pixel data. See Section C.7.6.6.1.2 for further explanation.
Stereo Pairs Present	**(0022,0028)**	**3**	**The multi-frame pixel data consists of left and right stereoscopic pairs. See Section C.7.6.6.1.3 for further explanation.** **Enumerated Values: YES, NO**

C.7.6.6.1 Multi-frame Attribute Descriptions

C.7.6.6.1.1 Number of Frames and Frame Increment Pointer

A Multi-frame Image is defined as a Image whose pixel data consists of a sequential set of individual Image Pixel frames. A Multi-frame Image is transmitted as a single contiguous stream of pixels. Frame headers do not exist within the data stream.

Each individual frame shall be defined (and thus can be identified) by the Attributes in the Image Pixel Module (see Section C.7.6.3). All Image IE Attributes shall be related to the first frame in the Multi-frame image.

The total number of frames contained within a Multi-frame Image is conveyed in the Number of Frames (0028,0008).

C.7.6.6.1.2 Frame Increment Pointer

The frames within a Multi-frame Image shall be conveyed as a logical sequence. The information that determines the sequential order of the frames shall be identified by the Data Element Tag or tags conveyed by the Frame Increment Pointer (0028,0009). Each specific Image IOD that supports the Multi-frame Module specializes the Frame Increment Pointer (0028,0009) to identify the Attributes that may be used as sequences.

Even if only a single frame is present, Frame Increment Pointer (0028,0009) is still required to be present and have at least one value, each of which shall point to an attribute that is also present in the Data Set and has a value.

Note

For example, in single-frame instance of an IOD that is required to or may contain the Cine Module, it may be appropriate for Frame Time (0018,1063) to be present with a value of 0, and be the only target of Frame Increment Pointer (0028,0009).

When the IOD Permits the use of Multi-frame Functional Groups as a Standard or Standard Extended SOP Class, Frame Increment Pointer may contain the single value of Per-frame Functional Groups Sequence (5200,9230) to indicate that the Functional Groups contain the descriptors of the frames.

Note

For example, the Multi-frame Grayscale Word SC Image IOD requires the Multi-frame Module but also permits the Multi-frame Functional Groups, for example, to describe the plane position of each frame.

C.7.6.6.1.3 Stereoscopic Pairs Present

Stereo Pairs Present (0022,0028) shall have the value of YES when frames within a Multi-frame Image are encoded as left and right stereoscopic pairs.

When Stereoscopic Pairs are present, and the pixel data is uncompressed, or compressed with a Transfer Syntax that does not explicitly convey the semantics of stereo pairs, the first and subsequent odd frames (frames numbered from 1) are the left frame of each pair, and the second and subsequent even frames are the right frame of each pair.

If the pixel data is compressed with a Transfer Syntax that does explicitly convey the semantics of stereo pairs, then the identification of the left and right frames in the compressed pixel data will be as defined in the compressed bit stream.

Note:

1. For example, the MPEG-4 AVC/H.264 Supplemental Enhancement Information (SEI) frame packing arrangement (FPA) field defines various methods of encoding stereo pairs. See PS3.5 Section 8.2.X MPEG-4 AVC/H.264 High Profile / Level 4.2 Video Compression. Videos encoded with this Transfer Syntax are used for what is colloquially referred to as "3D Television" applications. Section 8.2.Y MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 Video Compression defines a method of encoding stereo pairs without frame packing and with 2D backwards compatibility.

2. The presence of Stereo Pairs Present (0022,0028) is independent of the use of instances of the Stereometric Relationship IOD. In particular, no further description of the method of acquisition of the stereoscopic pairs is required, such as might be present in Attributes of the Stereo Pairs Sequence (0022,0020) of the Stereometric Relationship IOD. The definition of the references to left and right pairs in that IOD prohibit the encoding of the left and right pairs in the same instance, as distinct for the usage here.

3. Not all multi-frame IODs are sufficiently generic in their description to permit the presence of stereoscopic pairs. E.g., the Video Endoscopic Image IOD, Video Microscopic IOD and Video Photographic IODs are, since they do not specify any conflicting constraints on the meaning of the frames.

Amend Multi-frame Module to include Stereoscopic Pair information:

C.7.6.16 Multi-frame Functional Groups Module

Table C.7.6.16-1 specifies the attributes of the Multi-frame Functional Groups Module. This module is included in SOP instances even if there is only one frame in the instance.

Table C.7.6.16-1. Multi-frame Functional Groups Module Attributes

Attribute Name	Tag	Type	Attribute Description
...	...	...	...
Number of Frames	(0028,0008)	1	Number of frames in a multi-frame image. See Section C.7.6.6.1.1 for further explanation.
Stereo Pairs Present	**(0022,0028)**	**3**	**The multi-frame pixel data consists of left and right stereoscopic pairs. See Section C.7.6.6.1.3 for further explanation.** **Enumerated Values: YES, NO**
Concatenation Frame Offset Number	(0020,9228)	1C	Offset of the first frame in a multi-frame image of a concatenation. Logical frame numbers in a concatenation can be used across all its SOP instances. This offset can be applied to the implicit frame number to find the logical frame number in a concatenation. The offset is numbered from zero; i.e., the instance of a concatenation that begins with the first frame of the concatenation has a Concatenation Frame Offset Number (0020,9228) of zero. Required if Concatenation UID (0020,9161) is present.
...	...	...	...

…

Changes to NEMA Standards Publication PS 3.5

Digital Imaging and Communications in Medicine (DICOM)

Part 5: Data Structures and Encoding

Add references to section 2:

Section 2 Normative references

…

ISO/IS 14495-1	Lossless and near-lossless coding of continuous tone still images (JPEG-LS)
ISO/IEC 14496-10:2014	**Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding**
ISO/IEC 15444-1	JPEG 2000 Image Coding System

…

Add MPEG-4 AVC/H.264 High Profile / Level 4.2 video compression to Section 8.

8.2.X MPEG-4 AVC/H.264 High Profile / Level 4.2 Video Compression

DICOM provides a mechanism for supporting the use of MPEG-4 AVC/H.264 Image Compression through the Encapsulated Format (see PS 3.3). Annex A defines Transfer Syntaxes that reference the MPEG-4 AVC/H.264 Standard.

Note: MPEG-4 AVC/H.264 compression @ High Profile compression is inherently lossy. The context where the usage of lossy compression of medical images is clinically acceptable is beyond the scope of the DICOM Standard. The policies associated with the selection of appropriate compression parameters (e.g. compression ratio) for MPEG-4 AVC/H.264 HiP@Level4.2 are also beyond the scope of this standard.

The use of the DICOM Encapsulated Format to support MPEG-4 AVC/H.264 compressed pixel data requires that the Data Elements which are related to the Pixel Data encoding (e.g. Photometric Interpretation, Samples per Pixel, Planar Configuration, Bits Allocated, Bits Stored, High Bit, Pixel Representation, Rows, Columns, etc.) shall contain values that are consistent with the characteristics of the compressed data stream, with some specific exceptions noted here. The Pixel Data characteristics included in the MPEG-4 AVC/H.264 bit stream shall be used to decode the compressed data stream.

Notes: 1. These requirements are specified in terms of consistency with what is encapsulated, rather than in terms of the uncompressed pixel data from which the compressed data stream may have been derived.

2. When decompressing, should the characteristics explicitly specified in the compressed data stream be inconsistent with those specified in the DICOM Data Elements, those explicitly specified in the compressed data stream should be used to control the decompression. The DICOM data elements, if inconsistent, can be regarded as suggestions as to the form in which an uncompressed data set might be encoded.

The requirements are:

Planar Configuration (0028,0006) shall be 0

Samples per Pixel (0028,0002) shall be 3

Photometric Interpretation (0028,0004) shall be YBR_PARTIAL_420

Bits Allocated (0028,0100) shall be 8

Bits Stored (0028,0101) shall be 8

High Bit (0028,0102) shall be 7

Pixel Representation (0028,0103) shall be 0

The value of MPEG-4 AVC/H.264 sample aspect_ratio_idc shall be 1 in the encapsulated MPEG-4 AVC/H.264 bit stream if aspect_ratio_info_present_flag is 1.

Pixel Aspect Ratio (0028,0034) shall be absent. This corresponds to a 'Sampling Aspect Ratio' (SAR) of 1:1.

The values for Rows (0028,0010), Columns (0028,0011), Cine Rate (0018,0040) , and Frame Time (0018,1063) or Frame Time Vector (0018,1065) shall be compliant with the High Profile / Level 4.2 of the MPEG-4 AVC/H.264 standard (ISO/IEC 14496-10:2012) and restricted to a square pixel aspect ratio.

Notes: 1. The value of Planar Configuration (0028,0006) is irrelevant since the manner of encoding components is specified in the MPEG-4 AVC/H.264 standard, hence it is set to 0.

2. The frame rate of the acquiring camera for ’30 Hz HD’ MPEG-4 AVC/H.264 may be either 30 or 30/1.001 (approximately 29.97) frames/sec. Similarly, the frame rate in the case of 60 Hz may be either 60 or 60/1.001 (approximately 59.94) frames/sec. This may lead to small inconsistencies between the video timebase and real time. The relationship between frame rate and frame time is shown in Table 8-x.

3. The Frame Time (0018,1063) may be calculated from the frame rate of the acquiring camera. A frame rate of 29.97 frames per second corresponds to a frame time of 33.367 ms.

4. The value of chroma_format for this profile and level is defined by MPEG as 4:2:0.

Table 8-x

MPEG-4 AVC/H.264 High Profile / Level 4.2 IMAGE TRANSFER SYNTAX FRAME RATE ATTRIBUTES

Video Type	Frame Rate (see Note 2)	Frame Time (see Note 3)
30 Hz HD	30	33.33 ms
25 Hz HD	25	40.0 ms
60 Hz HD	60	16.17 ms
50 Hz HD	50	20.00 ms

Stereo Pairs Present (0022,0028) shall be YES if stereoscopic pairs are present, otherwise shall be NO or absent.

Table 8-y

MPEG-4 AVC/H.264 High Profile / Level 4.2 IMAGE TRANSFER SYNTAX STEREO ATTRIBUTES

Transfer Syntax	Stereo Pairs Present	Stereo Frame Packing Format
MPEG-4 AVC/H.264 High Profile / Level 4.2 for 2D Image Compression	NO or absent	absent
MPEG-4 AVC/H.264 High Profile / Level 4.2 for 3D Image Compression	YES	present

One fragment shall contain the whole MPEG-4 AVC/H.264 bit stream.

Note: If a video stream exceeds the maximum length of one fragment (approximately 4 GB), it may be sent as multiple SOP Instances, but each SOP Instance will contain an independent and playable bit stream, and not depend on the encoded bit stream in other (previous) instances. The manner in which such separate instances are related is not specified in the standard, but mechanisms such as grouping into the same Series, and references to earlier instances using Referenced Image Sequence may be used.

The container format for the video bitstream shall be MPEG-2 Transport Stream, a.k.a. MPEG-TS (see [ISO/IEC 13818-1]) or MPEG-4, a.k.a. MP4 container (see [ISO/IEC 14496-12] and [ISO/IEC 14496-14]). The PTS/DTS of the transport stream shall be used in the MPEG coding. Any audio components present within the bit stream shall be interleaved as defined for MPEG-4 AVC/H.264 High Profile Level 4.1. (see Section 8.2.7).

Add MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 video compression to Section 8.

8.2.Y MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 Video Compression

DICOM provides a mechanism for supporting the use of MPEG-4 AVC/H.264 Image Compression through the Encapsulated Format (see PS 3.3). Annex A defines a Transfer Syntax that references the MPEG-4 AVC/H.264 Standard.

MPEG-4 AVC/H.264 Stereo High Profile can achieve better compression by additionally making use of prediction between the base and dependent stereoscopic views. The base view frames make use of intra and inter prediction as in MPEG-4 AVC/H.264 High Profile. This makes it possible for decoders which do not know how to decode the stereoscopic data to decode only the base view. The dependent view is encoded to make use of redundancy due to prediction based upon similarities between the base and the dependent views.

MPEG-4 AVC/H.264 Stereo High Profile makes use of the Level table A-1 of the MPEG-4 specification to set through-put limits. The properties required by the MPEG-4 AVC/H.264 Stereo High Profile Compression are identical to the properties defined in Section 8.2.X, except that Stereo Pairs Present (0022,0028) shall always be YES.

The container format for the video bitstream shall be MPEG-2 Transport Stream, a.k.a. MPEG-TS (see [ISO/IEC 13818-1]) or MPEG-4, a.k.a. MP4 container (see [ISO/IEC 14496-12] and [ISO/IEC 14496-14]). The PTS/DTS of the transport stream shall be used in the MPEG coding. Any audio components present within the bit stream shall be interleaved as defined for MPEG-4 AVC/H.264 High Profile Level 4.1. (see Section 8.2.7).

Add TRANSFER SYNTAX FOR MPEG-4 AVC/H.264 High Profile / Level 4.2 COMPRESSION to Section 10.

10.X TRANSFER SYNTAXES FOR MPEG-4 AVC/H.264 HIP@LEVEL4.2 IMAGE COMPRESSION

One Transfer Syntax is specified for MPEG-4 AVC/H.264 High Profile / Level 4.2 for 2D Image Compression and one Transfer Syntax is specified for MPEG-4 AVC/H.264 High Profile / Level 4.2 for 3D Image Compression. Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 for 2D Image Compression corresponds to the ITU-T H.264 standard's profile and level specifications except that the use of frame packing formats for 3D video is not allowed as defined in Table 8-y. Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 for 3D Image Compression corresponds to the ITU-T H.264 standard's profile and level specifications. It should be used for transmitting stereoscopic 3D content with frame packing formats as defined in Table 8-y.

Add TRANSFER SYNTAX FOR MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 COMPRESSION to Section 10.

10.Y TRANSFER SYNTAX FOR MPEG-4 AVC/H.264 STEREO HIGH PROFILE / LEVEL 4.2 IMAGE COMPRESSION

One Transfer Syntax is specified for MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 Image Compression. Transfer Syntax MPEG-4 AVC/H.264 Stereo High Profile corresponds to the ITU-T H.264 standard's profile and level specifications.

Add MPEG-4 AVC/H.264 High Profile / Level 4.2 requirements to Annex A.

Annex A
(Normative)
Transfer Syntax Specifications

A.4.X MPEG-4 AVC/H.264 HIP@LEVEL4.2 VIDEO COMPRESSION

The International Standards Organization ISO/IEC MPEG4 has developed an International Standard, ISO/IEC 14496-10 (MPEG-4 Part 10), for the video compression of generic coding of moving pictures and associated audio information. This standard is jointly maintained and has identical technical content as the ITU-T H.264 standard.

A DICOM Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 for 2D Image Compression shall be identified by a UID value of:

1.2.840.10008.1.2.4.104 corresponding to the MPEG-4 AVC/H.264 High Profile / Level 4.2 of the ITU-T H.264 Video standard with the restriction that frame packing for stereoscopic 3D content shall not be used as defined in Table 8-y.

A DICOM Transfer Syntax MPEG-4 AVC/H.264 High Profile / Level 4.2 for 3D Image Compression shall be identified by a UID value of:

1.2.840.10008.1.2.4.105 corresponding to the MPEG-4 AVC/H.264 High Profile / Level 4.2 of the ITU-T H.264 Video standard. It should be used for transmitting stereoscopic 3D content with frame packing formats as defined in Table 8-y.

Add MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 requirements to Annex A.

Annex A
(Normative)
Transfer Syntax Specifications

A.4.Y MPEG-4 AVC/H.264 STEREO HIGH PROFILE /LEVEL 4.2 VIDEO COMPRESSION

The International Standards Organization ISO/IEC MPEG4 has developed an International Standard, ISO/IEC 14496-10 (MPEG-4 Part 10), for the video compression of generic coding of moving pictures and associated audio information. This standard is jointly maintained and has identical technical content as the ITU-T H.264 standard.

A DICOM Transfer Syntax for MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2 Image Compression shall be identified by a UID value of:

1.2.840.10008.1.2.4.106 corresponding to the MPEG-4 AVC/H.264 Stereo High Profile /Level 4.2 of the ITU-T H.264 Video standard.

Changes to NEMA Standards Publication PS 3.6

Digital Imaging and Communications in Medicine (DICOM)

Part 6: Data Dictionary

Add new data elements:

Table 6-1. Registry of DICOM Data Elements

Tag	Name	Keyword	VR	VM	
...	...	...	...	...	
(0022,0028)	**Stereo Pairs Present**	**StereoPairsPresent**	**CS**	**1**	

Add new UID to Annex A.

UID Value	UID Name	UID Type	Part
1.2.840.10008.1.2.4.104	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 2D Video	Transfer Syntax	PS 3.5
1.2.840.10008.1.2.4.105	MPEG-4 AVC/H.264 High Profile / Level 4.2 For 3D Video	Transfer Syntax	PS 3.5
1.2.840.10008.1.2.4.106	MPEG-4 AVC/H.264 Stereo High Profile / Level 4.2	Transfer Syntax	PS 3.5

Changes to NEMA Standards Publication PS 3.11

Digital Imaging and Communications in Medicine (DICOM)

Part 11: Media Storage Application Profiles

PS 3.11 Annex M: Editorial change

M General Purpose BD With Compression Interchange Profiles (Normative)

M.1 Profile Identification

This Annex defines an 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 readers shall support compression.**~~

…

PS 3.11: Add new General Purpose BD Application Profiles with MPEG-4 AVC/H.264 Level 4.2 compression:

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

X.1 Profile Identification

This Annex defines an 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 X.1-1. STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 Profiles

Application Profile	Identifier	Description
General Purpose BD Interchange with MPEG-4 AVC/H.264 HiP@Level4.2 for 2D	STD-GEN-BD-MPEG4-HPLV42-2D	Handles interchange of multi-frame images and video using MPEG-4 AVC/H.264

Application Profile	Identifier	Description
video		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 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.

X.2 Clinical Context

This 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 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 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 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.

X.2.1 Roles and Service Class Options

This 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.

X.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 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 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 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).

X.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 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 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.

X.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 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 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.

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

X.3.1 SOP Classes and Transfer Syntaxes

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

Table X.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 and UID	FSC Requirement	FSR Requirement	FSU Requirement
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 Syntax supported by this Application Profile are specified in the Table X.3-1. The supported Storage SOP Class(es) shall be listed in the Conformance Statement using a table of the same form.

X.3.2 Physical Medium and Medium Format

The STD-GEN-BD-MPEG4-LV42 and STD-GEN-SEC-BD-MPEG4-LV42 application profiles require any of the 120 mm BD media, as defined in PS3.12.

X.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 Application Profile shall be referenced by Directory Records.

Note

DICOMDIRs with no directory information are not allowed by this 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.

X.3.3.1 Additional Keys

File Set Creators and Updaters are required to generate the mandatory elements 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.

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X.3.4 Security Parameters

The STD-GEN-SEC-BD-MPEG4-LV42 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 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.