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Digital Imaging and Communications in Medicine (DICOM)

Supplement 225 :

Multi-Fragment Video Transfer Syntax

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Table of Contents

25 Document History 3
Open Issues 3
Closed Issues 3
Scope and Field of Application 4

Open Issues

1.	<p>Should this change be made as described where it modifies existing transfer syntaxes, or as a set of new transfer syntaxes?</p> <p>Advantages of modifying existing transfer syntaxes:</p> <ul style="list-style-type: none"> ● Consistent with what existing vendors already appear to be doing ● Avoids proliferation of transfer syntaxes <p>Advantages of new transfer syntaxes:</p> <ul style="list-style-type: none"> ● Avoids post-facto changes to the transfer syntax definition ● Avoids introducing previously compliant implementations now being non-compliant <p>Feedback from 6 vendors indicates that all 6 are already using the same transfer syntax with multiple fragments. Two vendors indicated that fragment sizes over 2 gb are problematic for their PACS.</p> <p>Feedback from any existing implementations that would have a problem with this is encouraged.</p>
2.	<p>Should fragmentation be allowed for videos smaller than 2^{31-4} bytes?</p> <p>Should it be discouraged if allowed?</p> <p>Advantage of discouraging the fragmentation is that it allows better backwards compatibility.</p> <p>Advantage of allowing fragmenting is that it is easier to write moderate size fragments for many implementations.</p>
3.	<p>Should there be a length field or just an indicator?</p> <ul style="list-style-type: none"> ● An indicator would just indicate “multi-fragments”, but is still transfer syntax/encoding dependent ● The length field breaks the layering, as it specifies something which is transfer syntax dependent ● The length field may be hard to know up front ● The length field allows for DICOMweb requests to support byte-range requests, something which is required for many video playback mechanisms
4.	<p>Should the number of frames be allowed to be omitted for video IODs only, as this value may not be known before encoding?</p>
5.	<p>Should this be documented in the conformance statement?</p>
6.	<p>Should the remaining video transfer syntaxes (8.2.9-8.2.11) be revised to use the same text?</p> <p>They indicate that fragmenting is allowed, but do not specify the pad bytes restriction or other comments.</p>

Closed Issues

1.	<p>Should the number of frames be allowed to be 64 bits?</p> <p>No, the number of frames attributes is already sufficiently large to allow for 20+ hours of video in a single object even at high frame rates.</p>
2.	<p>Should there be any specific requirements on where to split video fragments?</p> <p>No, other than the DICOM requirements of even bytes. The requirement on JPEG splitting was added in order to determine frame continuation, but that doesn't apply because all data</p>

	is in one encoding object. The fragments may be split in the middle of a frame or other object. This prevents DICOM implementations from needing to understand the internal video format.
3.	Should the total length field be included for Microscopy (C.8.12.4)? The only other number of frames locations is in C.8.12.4 beyond the multi frame module, and video is not used for microscopy, so the decision is to include this field.

Scope and Field of Application

35 This supplement modifies existing video transfer syntaxes to remove the restriction that the video cannot be broken up into multiple fragments. The affected transfer syntaxes are

- MPEG2 Main Profile / Main Level Video Compression
- MPEG2 Main Profile / High Level Video Compression
- MPEG-4 AVC/H.264 High Profile / Level 4.1 Video Compression
- MPEG-4 AVC/H.264 High Profile / Level 4.2 Video Compression

40 Videos of size larger than 2^{32} -4 bytes have started to appear (eg procedure video recordings). Previously, those videos needed to be split into multiple DICOM instances.

Add the following new content to PS3.3 Section 7.6.6

45 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

<u>Combined Fragment Length</u>	(gggg,00yy)	1C	<p><u>The length of the video stream in bytes, when all the fragments of the video stream have been recombined, not including any trailing padding added for encapsulation as a DICOM object.</u></p> <p><u>Required if the multi-frame image has been encoded in a single compressed representation split into more than one fragment. May be present otherwise.</u></p>
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50 *Modify the following portion of PS3.5 Sections 8.2.5, 8.2.6, 8.2.7 and 8.2.8 (same change 4 times)*

~~One fragment shall contain the whole MPEG2 stream.~~

The encapsulated video data stream may be segmented into more than one fragment. If segmented, then each fragment shall not exceed 2³¹-4 bytes. Segments other than the last one shall be of even length.

55 The encapsulated video data stream shall not be segmented unless the total size exceeds 2³¹-4 bytes (approximately 2 gb).

Note

60 1. ~~If a video stream exceeds the maximum length of one fragment, 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.~~

65 2. ~~This constraint limits the length of the compressed bit stream to no longer than 2³²-2 bytes.~~

1. A single fragment video stream may not exceed 2³²-4 bytes.

2. The standard previously disallowed multiple fragments for video streams. The requirement to not segment unless the video exceed 2 gb was added to maximize backwards compatibility.

70 3. The recipient is expected to concatenate the fragments while decoding them. This allows for streams of essentially unlimited length; the only limit imposed is the maximum Number of Frames (0028,0008) which is 2³¹-1 frames.

Add the following line to PS3.6 Table 6-1

(gggg,00yy)	Combined Fragment Length	CombinedFragmentLength	UV	1	
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