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JBIG JPEG

Joint Bi-level Image Joint Photographic

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Information technology- -— JPEG- XS low-latency lightweight image coding system—- —

Part 3:
Transport and container formats

FDIS stage

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Foreword

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This third edition cancels and replaces the second edition (ISO/IEC 21122-3:2022), which has been technically revised.

The main changes are as follows:

— ——support for JPEG XS codestreams using temporal differential coding (TDC).

— ——clarifications on coding of interlaced signals.

A list of all parts in the ISO/IEC 21122 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committeeswww.iso.org/members.html and www.iec.ch/national-committees.

Introduction

This document is part of a series of standards for a low-latency lightweight image coding system, denoted JPEG XS.

In many use cases during production or transmission of a movie, limiting the latency and the recompression loss is a more important aspect than the compression efficiency. The JPEG XS coding system offers compression and recompression of image sequences with very moderate computational resources while remaining robust under multiple compression and decompression cycles and mixing of content sources, e.g. embedding of subtitles, overlays or logos. Typical target compression ratios ensuring visually lossless quality are in the range of 2:1 to 20:1, depending on the nature of the source material. The end-to-end latency can be confined to a fraction of a frame, typically between a small number of lines down to below a single line.

This document specifies transport and container formats for JPEG XS codestreams. It also defines metadata that enriches transport protocols for transmission of image sequences, in order to facilitate transport, editing and presentation.

Information technology – — JPEG – XS low-latency lightweight image coding system ~~– Part 3: Transport and container formats~~ —

~~1~~ Part 3: Transport and container formats

1 Scope

This document defines transport and container formats for JPEG XS codestreams as specified in ISO/IEC 21122-1. It defines file formats for working with still image and motion image sequence files on computer platforms and gives guidance on how to embed the codestream in transport streams, allowing internet-based communication.

This document uses already existing specifications for file formats and extends them for the embedding of JPEG XS codestreams.

2 ~~2~~Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15076–1, *Image technology colour management – Architecture, profile format and data structure – Part 1: Based on ICC.1:2010*

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO/IEC 10646, *Information technology — Universal coded character set (UCS)*

ISO/IEC 11578, *Information technology — Open Systems Interconnection — Remote Procedure Call (RPC)*

ISO/IEC 14496–12, *Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 21122–1, *JPEG XS low-latency lightweight image coding system — Part 1: Core coding system*

ISO/IEC 21122–2, *JPEG XS low-latency lightweight image coding system — Part 2: Profiles and buffer models*

ISO/IEC 23008–12:~~2017~~2022, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format*

ISO/CIE 11664–1, *Colorimetry — Part 1: CIE standard colorimetric observers*

Rec. ITU-T H.273 | ISO/IEC 23091-2, *Coding-independent code points — Part 2: Video*

ANSI/CTA 861-G:2016, *A DTV Profile for Uncompressed High Speed Digital Interfaces*

W3C Recommendation, Extensible Markup Language (XML) 1.0 (Fifth Edition), 26 Nov. 2008 (https://www.w3.org/TR/REC-xml/)

Field Code Changed

3 3Terms and definitions

For the purposes of this document the terms and definitions given in ISO/IEC 14496-12, ISO/IEC 21122-1, ISO/IEC 21122-2, ISO/IEC 23008-12 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— —ISO Online browsing platform: available at https://www.iso.org/obphttps://www.iso.org/obp

— —IEC Electropedia: available at https://www.electropedia.org/https://www.electropedia.org/

3.1
aux
auxiliary component channel typically used as opacity channel or alpha mask

3.2
big-endian
byte ordering from the most significant to the least significant byte of multi-byte value representations

3.3
box
structured collection of data describing the image or the image decoding process

3.4
box content
data wrapped within the *box* (3.3)(3.3) structure

3.5
box type
kind of information stored with the *box* (3.3)(3.3)

3.6
byte
group of 8 bits

3.7
coding-independent code point
code point based on enumerated values for the definition of the colourspaces

Note 1 to entry: Code points defined in Rec. ITU-T H.273 | ISO/IEC 23091-2.

3.8
high efficiency image file format
image file format which can embed still images and *motion sequences* (3.11)(3.11)

Note 1 to entry: Based on ISO/IEC 23008-12.

3.9
image collection
unordered set of images without an implied or signalled presentation order or presentation time stamps

3.10
JXS
still image file format with JPEG XS compressed images

3.11
motion sequence
movie
timed sequence (3.15) of images

3.12
sample
<coding> single element in the two-dimensional image array which comprises a component

Note 1 to entry: This definition is used in Annex A.

3.13
sample
<ISOBMFF> all the data associated with a single time

Note 1 to entry: This definition is used in Annexes B and C as data associated with one coded image in a sequence.

3.14
superbox
box (3.3) that carries other boxes as payload data

3.15
timed sequence
linearly ordered sequence of media entities such as images where each entity is presented at a well defined time stamp

4 Symbols and abbreviated terms

4.1 Symbols

N_c	number of components in an image as defined in ISO/IEC 21122-1
P_{lev}	Level, sublevel and frame-buffer level (if applicable) a particular codestream conforms to as defined in ISO/IEC 21122-2
P_{pih}	profile a particular codestream conforms to as defined in ISO/IEC 21122-2
`Picture()`	JPEG XS codestream as defined in ISO/IEC 21122-1
`Codestream_Header()`	codestream header preceding the image data in the codestream without any `tpc_marker()` as defined in A.5.5 subclause A.5.5
`Codestream_Body()`	coded image data in the codestream including any `tpc_marker()` if such a marker is present, without `Codestream_Header()` as defined in A.5.5 subclause A.5.5

4.2 Abbreviated terms

For the purposes of this document the abbreviated terms given in ISO/IEC 14496-12, ISO/IEC 21122-1, ISO/IEC 21122-2, ISO/IEC 23008-12 and the following apply.

CICP	coding-independent code points
CIE	Commision Internationale de l'Eclairage
HEIF	high efficiency image file format
ISOBMFF	iso base media file format
LSB	least significant bit
MSB	most significant bit
UTF-8	8-bit Unicode transformation format as defined in ISO/IEC 10646

4.3 4.3 Naming conventions for numerical values

Integer numbers are expressed as bit patterns, hexadecimal values, or decimal numbers. Bit patterns and hexadecimal values have both a numerical value and an associated particular length in bits.

Hexadecimal notation, indicated by prefixing the hexadecimal number by "0x", may be used instead of binary notation to denote a bit pattern having a length that is an integer multiple of 4. For example, 0x41 represents an eight-bit pattern having only its second most significant bit and its least significant bit equal to 1. Numerical values that are specified under a "**Code**" heading in tables that are referred to as "code tables" are bit pattern values (specified as a string of digits equal to 0 or 1 in which the left-most bit is considered the most-significant bit). Other numerical values not prefixed by "0x" are decimal values. When used in expressions, a hexadecimal value is interpreted as having a value equal to the value of the corresponding bit pattern evaluated as a binary representation of an unsigned integer (i.e., as the value of the number formed by prefixing the bit pattern with a sign bit equal to 0 and interpreting the result as a two's complement representation of an integer value). For example, the hexadecimal value 0xF is equivalent to the 4-bit pattern '1111' and is interpreted in expressions as being equal to the decimal number 15.

5 5Conformance

This document shares common definitions for the structure of files (a sequence of objects, called boxes here, and atoms in other similar file formats), and a common definition of the general structure of an object (the size and type) as specified in Annex A.Annex A.

File formats representing either images, or image sequences shall follow the specifications in Annexes B, Cin Annexes B, C and DD. All these specifications require that readers ignore objects that are unrecognizable to them.

This document takes precedence over those on which it is based, in any case where there are differences or conflicts; however, no such conflicts are known to exist.

For better readability and understanding, the syntax description for the different file formats is done in the same way as in the base formats.

6 6Colour specification

JPEG XS (as defined in ISO/IEC 21122-1) describes only the encoded bitstream of an image. The integrated multiple component transformation is only responsible for a decorrelation of the different colour components allowing for the reduction of the entropy in the data. In order to properly display or interpret the image, it is essential that the colourspace of that image data is properly characterized. For this purpose, the respective container format or transport channel signals the correct colourspace. The defined formats in this document for JPEG XS signals the colour space as specified in Rec. ITU-T H.273 | ISO/IEC 23091-2.

7 Organization of the document

Annex A specifies boxes and superboxes that can be used to signal metadata for isolated JPEG XS codestreams or sequencs of JPEG XS codestreams. The boxes are identical or similar to the boxes defined in other ISO standards, e.g. JPEG 2000 (Rec. ITU-T T.800 | ISO/IEC 15444-1). The boxes defined in this annex are used throughout all other annexes of this document.

Annex B defines the JXS file format for still images based on JPEG XS codestreams and the boxes specified in Annex A.

Annex C specifies the integration of JPEG XS codestreams in the ISOBMFF (as defined in ISO/IEC 14496-12) for use of image sequences as movie in a file format.

Annex D specifies the integration of JPEG XS codestreams in the HEIF file format (as defined in ISO/IEC 23008-12) allowing the integration of both still images as well as movies in one format.

Annex E specifies the Media Type registration for JPEG XS codestreams solely any file format container, i.e. not contained within the file formats specified by Annex B, Annex C or Annex D.

Annex AAnnex A
(normative)

Syntax elements for JPEG XS compressed content

A.1 A.1 General

This annex defines syntax elements identifying and representing meta data of JPEG XS compressed images, image collections or image sequences. It forms the basis for file formats that applications may choose to wrap one or multiple JPEG XS codestreams. Annex BAnnex B describes a concrete file format that represents an individual JPEG XS image. This specification is based on the same syntax as the box-based file format for JPEG 2000 in ISO/IEC 15444-1:2019, Annex I or ISO/IEC 15444-2:2021, Annex- M.

This annex:

— specifies a binary container for image, image collections, image sequences and metadata;

— specifies a mechanism by which metadata (including vendor-specific information) can be included in files or transport streams specified by this document;

— specifies a mechanism to indicate image properties, such as the tonescale or colourspace of the image;

— specifies a mechanism by which readers can recognize the existence of intellectual property rights information in the file.

A.2 A.2 Specification of syntax elements

A.2.1 A.2.1 General

The syntax elements defined in this annex provide foundations for storing application specific data (metadata) in association with JPEG XS codestreams, such as information which is required to display the images or stream of images. As many applications require a similar set of information to be associated with the compressed image data, it is useful to define the format of that set of data along with the definition of the compression technology and codestream syntax.

Conceptually, the syntax elements specified in this annex encapsulate JPEG XS codestreams along with other core pieces of information about such codestreams. A file created from the syntax elements defined in this annex is loosely called a JPEG XS enabled file. Note, however, thatHowever, this annex does not define a file format itself, it only provides syntax elements upon which a file format can be defined. A concrete file format based on this annex is specified in Annex B. Annex B.

The building-block of all JPEG XS enabled files is called a box. All information is encapsulated in boxes. This annex defines several types of boxes; the definition of each specific box type defines the kinds of information that can be found within a box of that type. Some boxes will be defined to contain other boxes.

A.2.2 A.2.2 Greyscale, colour, multi-component specification

One of the most important aspects of a file format is that it specifies the colourspace of the contained image data. In order to properly display or interpret the image data, it is essential that the colourspace of that image is properly characterized. The syntax elements defined in this sectionsubclause provide one method to specify