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Information technologies — JPEG Systems —

Part 2: Transport mechanisms and packaging

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts of the ISO/IEC 19566 series can be found on the ISO website.

Introduction

Access to images and metadata using channels with limited bit rates can be significantly speed up by allowing proper decoding of partial representations. In this case, parts of the image can be displayed to the user or processed by an algorithm as soon as parts of the codestream or of the file are available at the client side.

Rec. ITU-T T.808 | ISO/IEC 15444-9 standardizes mechanisms called JPIP for incrementally communicating box-structured files, as well as information found within codestreams that may or may not be embedded within boxes of a box-structured file. By these means, standardized methods for accessing meaningful parts of an image are available.

So far, Rec. ITU-T T.808 | ISO/IEC 15444-9 is part of the JPEG 2000 standards. Other standards like JPEG (Rec. ITU-T T.81 | ISO/IEC 10918-1) or JPEG-XR (ISO/IEC 29199) are either not supported at all, or only in a very limited way. Consequently, application of JPIP is predominantly restricted to JPEG 2000. In the ambition to create an ecosystem of tools that can be applied to many or all standards of the JPEG family, this document gives guidelines for design of future compression standards and transmission formats such that partial access to images can be provided in a uniform manner based on the concepts and ideas of JPIP as defined in Rec. ITU-T T.808 | ISO/IEC 15444-9.

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Information technologies — JPEG Systems —

Part 2: Transport mechanisms and packaging

1 Scope

This document collects important information with the goal of elaborating a system layer for JPEG standards, referred to as JPEG systems.

This document summarizes the principles of incremental codestream and file transport that are intended to form the future building blocks JPEG systems. Industrial implementations, future codecs and systems components are encouraged to follow these guidelines.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms **REVIEW**

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3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

— ISO Online browsing platform: available at <u>https://www.iso.org/obp/</u>

3.1.1

bit stream

partially encoded or decoded sequence of bits comprising an entropy-coded segment

3.1.2

box

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

Note 1 to entry: See ISO/IEC 19566-1 for the definition of boxes.

3.1.3

box-based file format

file format whose composing elements are well-defined, hierarchically structured boxes

3.1.4 byte group of 8 bits

3.1.5 coder embodiment of a coding process

3.1.6

codestream

sequence of bits, representing a compressed image and associated metadata

3.1.7

coding

encoding or decoding

3.1.8

coding model

procedure (3.1.27) used to convert input data into symbols to be coded

3.1.9

(coding) process

general term for referring to an *encoding process* (3.1.16), a *decoding process* (3.1.14) or both.

3.1.10

compression

reduction in the number of bits used to represent source image data

3.1.11

component

two-dimensional array of samples (3.1.28) having the same designation in the output or display device

Note 1 to entry: An image typically consists of several components, e.g. red, green and blue.

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3.1.12 continuous-tone image

image whose components (3.1.11) have more than 1 bit per sample (3.1.28)

3.1.13

ISO/IEC TR 19566-2:2016 decoder https://standards.iteh.ai/catalog/standards/sist/dae47b65-125d-42af-bc42embodiment of a decoding process (3.1.14) 13dc8cd70/iso-jec-tr-19566-2-2016

3.1.14

decoding process process which takes as its input compressed image data and outputs a *continuous-tone image* (3.1.12)

3.1.15

encoder

embodiment of an encoding process (3.1.16)

3.1.16

encoding process

process which takes as its input a *continuous-tone image* (3.1.12) and outputs compressed image data

3.1.17

entropy-coded (data) segment

independently decodable sequence of entropy-encoded bytes of compressed image data

3.1.18

entropy decoder

embodiment of an entropy decoding (3.1.19) procedure

3.1.19

entropy decoding

lossless procedure which recovers the sequence of symbols from the sequence of bits produced by the entropy encoder (3.1.20)

3.1.20

entropy encoder

embodiment of an *entropy encoding* (3.1.21) procedure

3.1.21

entropy encoding

lossless procedure which converts a sequence of input symbols into a sequence of bits such that the average number of bits per symbol approaches the entropy of the input symbols

3.1.22

Joint Photographic Experts Group

JPEG

informal name of the committee that created this document

Note 1 to entry: The "joint" comes from the ITU-T and ISO/IEC collaboration.

3.1.23

JPEG standards

collection of ISO/IEC/ITU standards developed by the *Joint Photographic Experts Group* (3.1.22) for still imaging application as listed in <u>Clause 2</u>

3.1.24

JPEG systems

common elements of a system layer for JPEG standards (3.1.23)

3.1.25

metadata

additional data associated with the image data beyond the image data

3.1.26 iTeh STANDARD PREVIEW

collection of *sample* (<u>3.1.28</u>) values in the spatial image domain having all the same sample coordinates

EXAMPLE A pixel may consist of three samples describing its red, green and blue value.

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3.1.27 https://standards.iteh.ai/catalog/standards/sist/dae47b65-125d-42af-bc42-

procedure e2d13dc8cd70/iso-iec-tr-19566-2-2016

set of steps which accomplishes one of the tasks which comprise an *encoding* (3.1.16) or *decoding process* (3.1.14)

3.1.28

sample

one element in the two-dimensional image array which comprises a *component* (3.1.11)

3.1.29

superbox

box (3.1.2) that itself contains a contiguous sequence of boxes, and only a contiguous sequence of boxes

3.2 Abbreviated terms

- ID identifier
- JP2 JPEG 2000 file format
- JPEG Joint Photographic Experts Group
- JPIP JPEG 2000 interactive protocol
- JPX extended JPEG 2000 file format
- MJ2 motion JPEG 2000 file format

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- OSI open systems interconnection
- ROI region of interest
- XML extensible markup language

4 Conventions

4.1 **Operators**

NOTE Many of the operators used in this document are similar to those used in the C programming language.

4.1.1 Arithmetic operators

- + Addition
- Subtraction (as a binary operator) or negation (as a unary prefix operator)
- * Multiplication
- / Division without truncation or rounding
- smod x smod a is the unique value y between $-\lceil (a-1)/2 \rceil$ and $\lfloor (a-1)/2 \rfloor$ for which y \neq Na = x with a suitable integer NREVIEW
- umod x umod a is the unique value y between 0 and a-1 for which y + Na = y with a suitable integer N

4.1.2 Logical operators ISO/IEC TR 19566-2:2016 https://standards.iteh.ai/catalog/standards/sist/dae47b65-125d-42af-bc42-

e2d13dc8cd70/iso-iec-tr-19566-2-2016||Logical OR&&Logical AND!Logical NOT \in $x \in \{A, B\}$ is defined as (x == A || x == B) \notin $x \notin \{A, B\}$ is defined as (x != A && x != B)

4.1.3 Relational operators

- > Greater than
- ≥ Greater than or equal to
- < Less than
- ≤ Less than or equal to
- == Equal to
- != Not equal to

4.1.4 Precedence order of operators

Operators are listed below in descending order of precedence. If several operators appear in the same line, they have equal precedence. When several operators of equal precedence appear at the same level

in an expression, evaluation proceeds according to the associativity of the operator, either from right to left or from left to right.

Operators	Type of operation	Associativity
(), [], .	Expression	Left to right
_	Unary negation	
*, /	Multiplication	Left to right
umod, smod	Modulo (remainder)	Left to right
+, -	Addition and Subtraction	Left to right
< , >, ≤, ≥	Relational	Left to right

4.1.5 Mathematical functions

$\lceil \mathbf{x} \rceil$	Ceil of x. Returns the smallest integer that is greater than or equal to x.
Lx.	Floor of x. Returns the largest integer that is lesser than or equal to x.
x iTeh S	Absolute value. Is $-x$ for $x < 0$, otherwise x.
sign(x)	Sign of x. Zero if x is zero, 41 if x is positive, -1 if x is negative.
clamp(x,min,max) https://standards.it	Cla <u>mps x to the range (m</u> in,max). Returns min if x < min, max if x > max, or otherwise x25d-42af-bc42-
power(x, a)	2d13dc8cd70/iso-jec-tr-19566-2-2016 Raises the value of x to the power of a. x is a non-negative real number, a is a real number. Power(x,a) is equal to $exp[a \times log(x)]$ where exp is the exponential function and log() is the natural logarithm. If x is zero and a is positive, power(x,a) is defined to be zero.

5 General

The purpose of this clause is to give an informative overview of the elements referred to in this document. Another purpose is to introduce many of the terms which are defined in <u>Clause 3</u>. These terms are printed in *italics* upon first usage in this clause.

There are three elements referred to in this document.

- a) An *encoder* is an embodiment of an *encoding process*. An encoder takes as input *digital source image data* and *encoder specifications*, and by means of a specified set of *procedures*, generates as output a *codestream*.
- b) A *decoder* is an embodiment of a *decoding process*. A decoder takes as input a codestream, and by means of a specified set of procedures, generates as output *digital reconstructed image data*.
- c) The *codestream* is a compressed image data representation which includes all necessary data to allow a (full or approximate) reconstruction of the sample values of a digital image. Additional data might be required that define the interpretation of the sample data, such as colour space or the spatial dimensions of the samples.