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Information technology — JPEG Systems —

Part 10: Reference software

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Foreword

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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*.

A list of all parts in the ISO 19566 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-committees.

Introduction

The JPEG Universal Metadata Box Format (JUMBF) provides a mechanism to embed and refer generic metadata in JPEG files. Specific content types can be assigned to identify the specific type of the embedded metadata.

This document describes a reference software implementation that handles JUMBF data according to the Content Types specified in ISO/IEC 19566-5. Initially, the JUMBF reference dataset is presented, consisting of standalone JUMBF files as well as JPEG-1 encoded images. In addition, the respective validation procedure is specified which enables the validation of candidate implementations of ISO/IEC 19566-5. Finally, a detailed analysis of the Java reference implementation of ISO/IEC 19566-5 is presented, demonstrating the software design which is followed to support the JUMBF data model.

Information technology — JPEG Systems —

Part 10:
Reference software

1 Scope

This document specifies a reference software implementation of ISO/IEC 19566-5. The reference software is accompanied with a reference dataset which provides an extensive list of the various JUMBF data structures specified in ISO/IEC 19566-5.

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/IEC 19566-5, *Information technologies — JPEG systems — Part 5: JPEG universal metadata box format (JUMBF)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions 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/obp

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

3.1.1
codestream
compressed image data representation that includes all necessary data to allow a (full or approximate) reconstruction of the sample values of a digital image

3.2 Abbreviated terms

APP11	application marker 11: JPEG XT extension marker
CBOR	concise binary object representation
CLI	command line interface
CSV	comma separated values
GUI	graphical user interface
IoC	inversion of controls
ISOBMFF	ISO base media file format

IV	initial value
JPEG	joint photographic experts group
JPEG-1	image complying to ISO/IEC 10918-1
JP2C	JPEG contiguous codestream
JSON	JavaScript[1)] object notation
JUMBF	jpeg universal metadata box format
POJO	plain old java object
UUID	universally unique identifier
XML	extensible markup language

4 Reference software

4.1 Purpose

The use of the reference software is not required for making an implementation of parser or generator in conformance to any of the parts of the ISO/IEC 19566 series. Requirements established in all parts of the ISO/IEC 19566 series take precedence over the behaviour of the reference software.

4.2 Examples of use

This subclause enumerates possible uses of the reference implementations presented in the annexes:

a) Sample parser. Users can use the reference implementations to inspect, even through visualization, the structure and contents of the JUMBF data model as specified in ISO/IEC 19566.

b) Sample generator. Users could use the reference implementations to create JUMBF files that could be used to facilitate the development of applications that take advantage of the benefits of JUMBF specification.

c) Provide anchor implementations for development purposes. JUMBF data model developers could study the reference implementations presented in the annexes in order to gain better insight on the algorithms as well as on how JUMBF Boxes are interconnected.

d) Provide anchor implementations to test possible conformant software. This facilitates developers to have an existing implementation act as a ground truth which will assist them assess the validity of their own implementations.

The lack of detection of any conformance violation by any reference software implementation should not be considered as a definite proof that the codestream under testing conforms to all constraints required for it to be conforming to one of the parts of the ISO/IEC 19566 series. Similarly, the computation resource characteristics in terms of program or data memory usage, execution speed, etc. of sample software encoder or decoder implementations shall not be construed as a representative of the typical, minimal or maximal computational resource characteristics to be exhibited by implementations of some parts of the ISO/IEC 19566 series.

1) JavaScript™ is the trademark of a product supplied by Oracle® Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4.3 Warranty disclaimer

Regardless of any and all statements made herein or elsewhere regarding the possible uses of the reference software, the following disclaimers of warranty apply to the provided reference software implementations:

— ITU, ISO and IEC disclaim any and all warranties, whether express, implied, or statutory, including any implied warranties of merchantability or of fitness for a particular purpose.

— In no event shall the contributor(s) or ITU, ISO or IEC be liable for any incidental, punitive or consequential damages of any kind whatsoever arising from the use of these programs.

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— Commercial applications of ITU-T Recommendations and ISO/IEC International Standards, including shareware, may be subject to royalty fees to patent holders.

4.4 General

The rest of the document describes several reference software implementations. The reference software for this document is available at https://standards.iso.org/iso-iec/19566/-10/ed-1/en/. Reference software implementations do not intend to be unique. Therefore, some parts of JPEG Systems can have more than one implementation. On the other hand, reference software implementations need to be validated, from functionality and interoperability points of view. Hence, Annex A describes the mechanism followed for validation of the JUMBF reference software. Annex B describes an implementation of reference software for JUMBF (as specified in ISO/IEC 19566-5). The implementations presented in the subsequent annexes are summarized in Table 1, including information related to the parts of the ISO/IEC 19566 series they cover, the provided functionalities as well as the technology used.

Table 1 — Reference software implementations for the ISO/IEC 19566 series

Annex	Software	ISO/IEC 19566 parts	Decoder	Encoder	Technology
Annex B	jumbf-2.0 library	ISO/IEC 19566-5	Yes	Yes	Java[a]

[a] Java™ is the trademark of a product supplied by Oracle® Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Annex A
(informative)

Validation of ISO/IEC 19566-5 (JUMBF) reference software

A.1 General

This subclause describes the validation process that is followed in order to verify the correctness of ISO/IEC 19566-5 reference software implementations. The validation procedure deals with parser and generator implementations separately. Along with the validation procedure, the JPEG Systems reference dataset is included. In principle, any reference implementation presented in this document can parse/generate the reference files of the related part of the ISO/IEC 19566 series.

In general, the aim of the JPEG Systems reference dataset is to address all the available JUMBF Content Types specified in the scope of the ISO/IEC 19566 series and covering cases of standalone JUMBF files, but also embedding JUMBF Boxes in supporting image file formats. The JPEG Systems reference dataset is split into multiple subdirectories, each of which corresponds to a specific part of the ISO/IEC 19566 series that specifies JUMBF data structures. All the available parts of the ISO/IEC 19566 series and the respective JUMBF Content Types that are specified in each one of them is listed in Table A.1.

Table A.1 — JUMBF Content Types as defined in the ISO/IEC 19566 series

Directory name	JUMBF Content Types
Part 5	XML, JSON, JP2C, CBOR, UUID, Embedded File
Part 4	Protection, Replacement
Part 6	JPEG 360
Part 7	JLINK
Part 8	JPEG Snack

A.2 JUMBF reference dataset

The first version of the JPEG Systems reference dataset — which is attached along with this document — consists of exactly one directory, namely the JUMBF reference dataset. This directory consists of an exhaustive list of standalone JUMBF files covering ISO/IEC 19566-5. All these files cover plenty of combinations for the available JUMBF Description box attributes and Content Types in ISO/IEC 19566-5. A detailed description about the information of each of the available files is given in the reference dataset description, a csv file which accompanies the dataset and signals the contents of the Description box and the respective Content Boxes. The columns of the reference dataset description file for JUMBF reference dataset are presented in Table A.2. To specify the content of a JUMBF Box (e.g., the XML payload of an XML Content type JUMBF box), a set of input files is included in the dataset. The file name of each of the input documents is referenced through the csv file in the respective columns. In scope of ISO/IEC 19566-5 the contents of a JUMBF Box can be an XML serialized content, a JSON serialized content, a CBOR serialized content, a JPEG codestream or a generic bytestream. In principle, with the reference dataset description file it is possible to define any combination of JUMBF data. Specifically, columns A-K refer to all the various combinations related to the Description box data model. Columns L and M specify the expected number and content (i.e., input file) of the Content Box for each JUMBF Box defined in ISO/IEC 19566-5. Next, columns N-O correspond to the specific fields defined in UUID Content type JUMBF box, while columns P-R correspond to those of Embedded File Content type JUMBF box. Finally, column S points to the file name of the generated file where the JUMBF data is going to be stored. If a column is not applicable for a specific JUMBF structure, “NULL” value is used. Each line of the csv defines a JUMBF Box that is stored either as a standalone file or embedded in a host image which is encoded using one of the available JPEG encoding formats. Normally, each line