
**Information technologies — JPEG
systems —**

**Part 4:
Privacy and security**

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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.

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) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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/IEC 19566 series can be found on the ISO website.

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.

Introduction

This document contributes to the specification of system-level functionalities. In particular, it specifies functionalities to provide a degree of trust while sharing image content and metadata, which simultaneously also allow the signalling of the associated access policies.

A huge number of images are distributed over the internet on a daily basis. For social media alone, this already accounts for over 3 billion pictures. These photos are often shared with many people without protection for personal information or access control. In addition, many portable devices have communication functionality that allows for the immediate distribution of photos after capturing them. In combination with the potential inclusion of GPS information in the file format, for example, the photo might expose private and geo-location information to the world.

In order to avoid such undesirable situations, the framework in this document provides protection mechanisms to the JPEG family of standards. For instance, encryption can be used to protect image data

The particular focus of this document is to provide codestream and file format syntax support to enable security and privacy functionality for JPEG standards, not only in support of ISO/IEC 10918-1, but also for standards such as ISO/IEC 15444 and ISO/IEC 18477.

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Information technologies — JPEG systems —

Part 4: Privacy and security

1 Scope

This document specifies privacy and security features which contribute to a system layer for JPEG standards. It defines generic structures that can be applied in all JPEG box-based file formats. In particular, this document specifies a signalling syntax supporting privacy and security features. The framework in this document is backwards-compatible with existing JPEG standards.

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.

ITU-T T.81 | ISO/IEC 10918-1, *Information technology — Digital compression and coding of continuous-tone still images: Requirements and guidelines*

ISO/IEC 18477-3, *Information technology — Scalable compression and coding of continuous-tone still images box file format*

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

ISO/IEC 18033-3, *Information technology — Security techniques — Encryption algorithms — Part 3: Block ciphers*

ISO/IEC 19566-5, *Information technology — JPEG systems — Part 5: JPEG universal metadata box format*

3 Terms and definitions

3.1 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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

box

binary structure that encapsulates an object embedded in a file

[SOURCE: ISO/IEC 19566-5:2019, 3.1.1]

3.1.2

codestream

sequence of bits representing a compressed image and associated metadata

[SOURCE: ISO/IEC 19566-5:2019, 3.1.2]

3.1.3

decrypted content

resulting data after applying the signalled decryption process on the encrypted content

3.1.4

master image

image file in which the *box* (3.1.1) is embedded

3.1.5

JPEG-1 image

image encoded in JPEG file format

Note 1 to entry: The image shall be encoded in compliance to ISO/IEC 10918-1.

3.1.6

box-based file format

file format whose composing elements are boxes containing structured data in compliance with ISO-based media file format

3.1.7

JPEG XT image

image encoded in the JPEG XT file format

Note 1 to entry: the images shall be encoded in compliance to ISO/IEC 18477.

3.1.8

Replacement Data box

sequence of *boxes* (3.1.1) of any type embedded in a JUMBF Replacement box

3.2 Abbreviated terms

JPEG joint photographic experts group

JUMBF JPEG universal metadata box format

P&S privacy and security

ROI region of interest

TOG toggles

4 Conventions

4.1 Conformance language

In this document, the following verbal forms are used:

- “shall” indicates a requirement;
- “should” indicates a recommendation;
- “may” indicates a permission;
- “can” indicates a possibility or a capability.

Information marked as “NOTE” is intended to assist the understanding or use of the document. “Notes to entry” used in [Clause 3](#) provide additional information that supplements the terminological data and can contain provisions relating to the use of a term.

The keyword "reserved" indicates a provision that is not specified at this time, shall not be used, and may be specified in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be specified in the future.

4.2 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 indicated as "binary" are bit pattern values (specified as a string of digits equal to 0, 1 or x in which the left-most bit is considered the most-significant bit and 'x' means either 0 or 1). 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.

4.3 Boxes and superboxes

[Annex A](#) shall be used for the specification of boxes. The details for embedding boxes in specific file formats are defined in the particular specifications, for example, ISO/IEC 15444-1 for JPEG 2000, ISO/IEC 18477-3 for JPEG-1 and JPEG XT or the more generic ISO/IEC 14496-12 ISO base media file format (ISO/BMFF).

In general, each object in the file is encapsulated within a binary structure called a box. A box that only contains other boxes is called a superbox. The binary structure is given in [Figure 1](#).

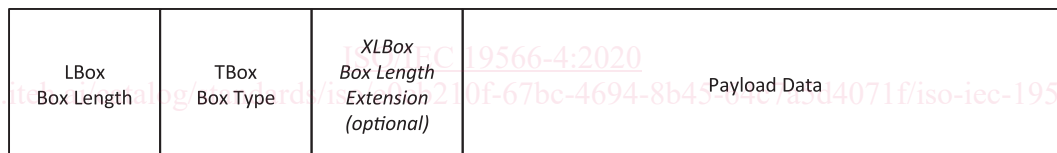


Figure 1 — Binary structure of a box

- **LBox:** Box length. This field specifies the length of the box, stored as a 4-byte big-endian unsigned integer. This value includes all of the fields of the box, including the length and type. If the value of this field is 1, then the X_LBox field shall exist and the value of that field shall be the actual length of the box. If the value of this field is 0, then the length of the box was not known when the LBox field was written. In this case, this box contains all bytes up to the end of the file. If a box of length 0 is contained within another box (its superbox), then the length of that superbox shall also be 0. This means that this box is the last box in the file. The values 2-7 are reserved for ITU-T | ISO use.
- **TBox:** Box type. This field specifies the type of information found in the Payload Data field. The value of this field is encoded as a 4-byte big-endian unsigned integer. However, boxes are generally referred to by an ISO/IEC 646 character string translation of the integer value. For all box types defined within this document, box types will be indicated as both character string and as 4-byte hexadecimal integers. Also, a space character is shown in the character string translation of the box type as "\040". All values of TBox not defined within this document are reserved for ITU-T | ISO/IEC use.
- **X_LBox:** Box extended length. This field specifies the actual length of the box if the value of the LBox field is 1. This field is stored as an 8-byte big-endian unsigned integer. The value includes all of the fields of the box, including the LBox, TBox and X_LBox fields.

- **Payload Data:** Box contents. This field contains the actual information contained within this box. The format of the box contents depends on the box type and will be defined individually for each type.

4.4 Graphical descriptions

Box definitions contain graphical description figures to illustrate the structure of the box. These figures should be interpreted as follows:

- The figures do not include box type and length fields.
- A sequence of rectangles is used to indicate the remaining fields of the box and their order.
- The width of the rectangle indicates the length of the field, a square rectangle indicates a 16-bit field.
- A grey background indicates a variable length field.
- Optional fields have a dashed border.

Figure 2 shows an illustrative example of a box with four fields:

- A: 8-bit required field;
- B: 16-bit required field;
- C: variable length required field;
- D: optional 32-bit field.



Figure 2 — Box with four fields

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5 Organization of the document

This document is organized as follows:

- [Annex A](#) specifies the mechanisms for content protection and replacement to support privacy and security features.
- [Annex B](#) provides several illustrative usage examples.

Annex A (normative)

Content protection and replacement

A.1 General

This annex specifies mechanisms for content protection and replacement. Content protection and replacement can be combined to support partial image protection. This annex builds upon the JPEG universal metadata box format (JUMBF), hence all implementations shall be compliant with ISO/IEC 19566-5.

A.2 Content protection

A.2.1 General

Content protection enables the protection of parts of an image file by encryption. When decoding an image file with protected content, the protected content shall be decrypted using the signalled encryption method, provided that the encryption method is supported by the decoder and authorization is granted. In case the protected content cannot be decrypted, the entire protected content shall be ignored. The process is illustrated in [Figure A.1](#).

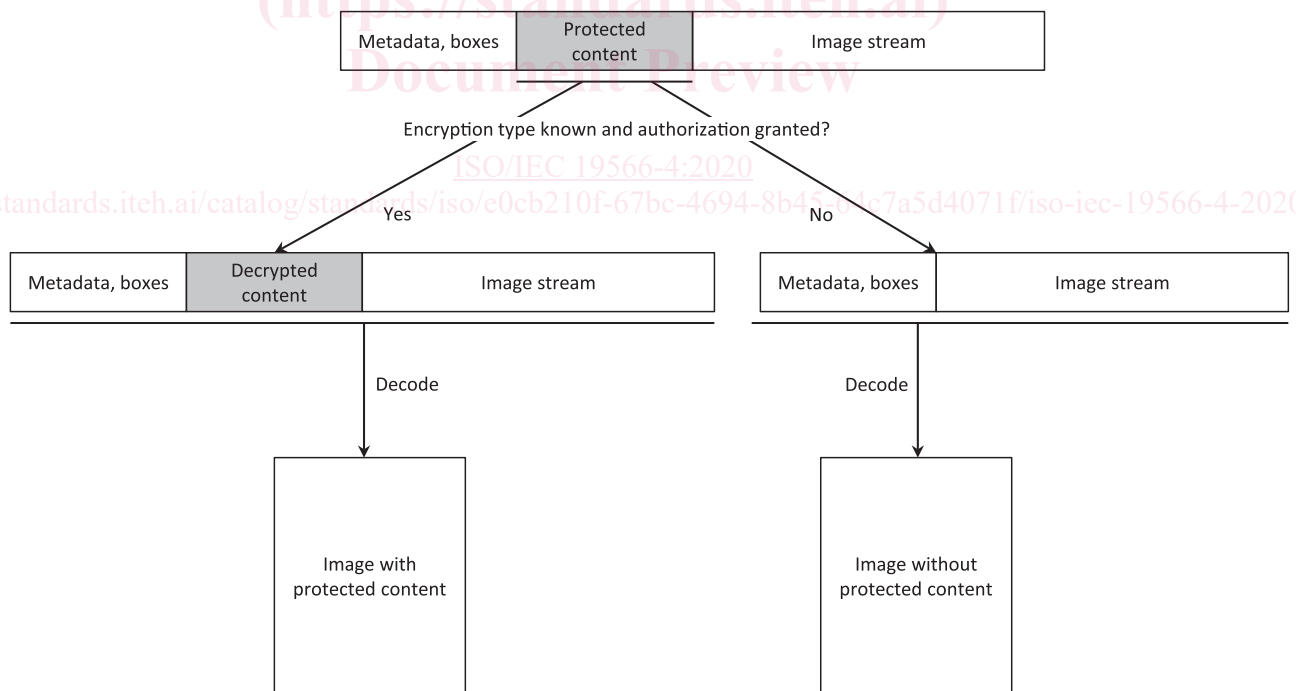


Figure A.1 — Content protection decoding process

The protected content is embedded in the master image file as a JUMBF box with Content Type “Protection”, as specified in [A.2.2](#).