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SERIES T: TERMINALS FOR TELEMATIC SERVICES

Still-image compression – JPEG 2000

Information technology – JPEG 2000 image coding system – Encapsulation of JPEG 2000 images into ISO/IEC 23008-12

Recommendation ITU-T T.815

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INTERNATIONAL STANDARD ISO/IEC 15444-16
RECOMMENDATION ITU-T T.815

Information technology – JPEG 2000 image coding system – Encapsulation of JPEG 2000 images into ISO/IEC 23008-12

Summary

ISO/IEC 23008-12 specifies a framework for the interchange of images and image sequences using tools defined in the ISO base media file format (ISO/IEC 14496-12), which is in wide use worldwide. This framework is defined independently of the formats of the images and image sequences, allowing a wide range of such formats to be used in combination with ISO/IEC 23008-12.

To simplify the use of the JPEG 2000 family of image formats (Rec. ITU-T T.8xx series | ISO/IEC 15444) in applications that use the ISO base media file format, Rec. ITU-T T.815 | ISO/IEC 15444-16 specifies the encapsulation of these image formats in the framework defined in ISO/IEC 23008-12 and related applications such as ISO/IEC 23000-22.

Recommendation ITU-T T.815 (2021) is a common text with ISO/IEC 15444-16:2021.

This second edition cancels and replaces the first edition, which has been technically revised.

The main changes compared to the previous edition are as follows:

- the encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences is deprecated, and replaced by the encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 image sequences;
- adds support for quality and resolution layers;
- the syntax and semantics of the JPEG 2000 header item property are clarified; and reader conformance requirements are removed.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T T.815	2019-06-13	16	11.1002/1000/13913
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Images, ISO base media file format, JPEG 2000.

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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INTERNATIONAL STANDARD ISO/IEC 15444-16
RECOMMENDATION ITU-T T.815

Information technology – JPEG 2000 image coding system – Encapsulation of JPEG 2000 images into ISO/IEC 23008-12

1 Scope

This Recommendation | International Standard specifies the encapsulation of image formats specified in the JPEG 2000 family of Recommendations | International Standards in the framework defined in ISO/IEC 23008-12.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. At the time of publication, the editions indicated in dated references were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

– Recommendation ITU-T T.800 (latest) | ISO/IEC 15444-1: (latest), *Information technology – JPEG 2000 image coding system – Core coding system.*

2.2 Paired Recommendations | International Standards equivalent in technical content

None.

2.3 Additional references

– ISO/IEC 23008-12:2017, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part12: Image file format*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation | International Standard uses the following terms defined elsewhere:

For the purposes of this Recommendation | International Standard, the definitions given in ISO/IEC 23008-12 apply. ITU, ISO and IEC maintain terminological databases for use in standardization at the following addresses:

– ITU terminology database: https://www.itu.int/go/terms

– ISO Online browsing platform: https://www.iso.org/obp

– IEC Electropedia: http://www.electropedia.org/

3.2 Terms defined in this Recommendation | International Standard

This Recommendation | International Standard defines the following terms:

None.

4 Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

JPEG Joint Photographic Experts Group

5 Conventions

None.

6 Encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 images and image collections

6.1 General

This clause specifies the encapsulation of individual JPEG 2000 codestreams, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1, as individual images or as image collections as specified in ISO/IEC 23008-12.

6.2 JPEG 2000 coded image item

A JPEG 2000 coded image item is a coded image item, as defined in ISO/IEC 23008-12, with type `'j2k1'` that conforms to the provisions of this subclause.

The body of the coded image item shall be exactly one Contiguous Codestream box as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.

NOTE 1 – The JPEG 2000 codestream contained in the Contiguous Codestream box can require capabilities not defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, including those specified in Rec. ITU-T T.814 | ISO/IEC 15444-15. Such required capabilities are signalled in the CAP Marker Segment specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.

The coded image item shall be associated with exactly one JPEG 2000 header item property specified in 6.3, and the `essential` field of the item property shall be equal to 1.

The coded image item shall be associated with exactly one `'colr'` item property, and the essential field of that item property shall be equal to 1.

If a `'pixi'` item property is associated with the coded image item, its information shall be consistent with the $\texttt{Ssiz}^{i}$ fields of the `SIZ` marker of the JPEG 2000 codestream within the Contiguous Codestream box.

If a `'lsel'` item property is associated with the coded image item, then:

- the `layers` field of the JPEG 2000 header item property shall be present and contain an entry with a `layer_id` field equal to that of the `'lsel'` item property; and
- the decoded image shall be the result of decoding the layer identified by the `layer_id` field of the `'lsel'` item property.

The `image_width` and `image_height` fields of the `'ispe'` item property shall be equal to width and height of the decoded image.

NOTE 2 – Item properties other than those referenced above can be associated with the coded image item.

6.3 JPEG 2000 header item property

6.3.1 Syntax

```
class J2KHeaderItemProperty extends ItemProperty('j2kH') {
    J2KChannelDefinition    channels;
    J2KComponentMapping     components;
    J2KPalette              palette;
    J2KLayers               layers;
}
```

NOTE – All boxes are optional unless specified otherwise, and boxes other than those listed above can be present.

6.3.2 channels field

The `channels` field is a Channel Definition box, as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1.

The `channels` field shall be present.

Each $\texttt{Typ}^i$ value shall be equal to 0, 1, or 2.

If $\texttt{Typ}^i$ is equal to 0, then $\texttt{Asoc}^i$ shall be in the range $[1, 2^{16} - 2]$.

At most one $\texttt{Typ}^i$ value shall be equal to 1 or 2, and the corresponding $\texttt{Asoc}^i$ field shall be equal to 0.

NOTE – At most one alpha channel is allowed.

6.3.3 components field

The `components` field is a Component Mapping box, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.

If the `components` field is absent, the components of the codestream shall be mapped directly to channels, such that component `i` is mapped to channel `i`.

The $\texttt{CMP}^i$ values shall be equal to 0 or 1.

If one or more $\texttt{CMP}^i$ value is equal to 1, then the `palette` field, as specified in 6.3.4, shall be present.

If the `palette` field is absent, then the `components` field shall be absent.

6.3.4 palette field

The `palette` field is a Palette box, as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1.

Each entry of the `palette` field shall be referenced by one or more $\texttt{PCOL}^i$ fields of the `components` field specified in 6.3.3.

6.3.5 layers field

The `layers` field is a Palette box, as defined in Rec. ITU-T T.800 | ISO/IEC 15444-1.

6.4 JPEG 2000 layers box

6.4.1 General

The JPEG 2000 layers box declares a list of quality and resolution layers of a JPEG 2000 codestream.

NOTE – The JPEG 2000 codestream can contain layers not listed in the JPEG 2000 layers box.

6.4.2 Syntax

```
class J2KLayers extends FullBox('j2kL') {
    unsigned int (16) num_layers;
    for (i=0; i < num_layers; i++) {
        unsigned int(16) layer_id;
        unsigned int(8) discard_levels;
        unsigned int(16) decode_layers;
    }
}
```

6.4.3 num_layers field

The `num_layers` field is the number of declared layers.

6.4.4 layer_id field

The `layer_id` field identifies the layer.

No two values of the `layer_id` field in an instance of the box shall be identical.

NOTE – The value `layer_id` field can be referenced from the `'lsel'` item property.

6.4.5 discard_levels field

The `discard_levels` field specifies the number of resolution levels of the JPEG 2000 codestream that can be discarded.

6.4.6 decode_layers field

The `decode_layers` field specifies the minimum number of quality layers of the JPEG 2000 codestream to be decoded.

6.5 File conformance

A file that includes `'j2ki'` as a compatible brand:

- shall conform to the `'mif1'` brand as specified in ISO/IEC 23008-12.
- shall contain one or more JPEG 2000 coded image item specified in 6.2.

NOTE – This Recommendation | International Standard does not specify reader conformance for the `'j2ki'` brand.

6.6 Media type

The `image/hej2k` media type, as defined in 6.7, refers to content that consists of a single file that conforms to the `'j2ki'` brand specified in 6.5.

6.7 Media type registration

6.7.1 General

Many Internet protocols are designed to carry arbitrary labelled content. The mechanism used to label such content is a media type, which is defined in IETF RFC 6838 and consists of a top-level type, a subtype, and in some instances, optional parameters.

The media type specification of the following clause has a matching registration in the IANA central registry, as specified in IETF RFC 6838.

6.7.2 Registration

Type name: image

Subtype name: hej2k

Required parameters: None

Optional parameters: Same as for the media type image/heif. The presence of an image item of type 'j2ki' is signalled by including, in the itemtypes parameter, an item description whose item type string starts with 'j2ki'.

Encoding considerations: binary

Notes: None

Security considerations: See media type image/heif. In addition, image items of type 'j2ki' contain structures of variable length and have an extensible syntax. Both aspects present potential security risks for implementations. In particular, variable length structures present buffer overflow risks and extensible syntax could result in the triggering of adverse actions.

Interoperability considerations: Same as for the media type image/heif. In addition, image items of type 'j2ki' can conform to one of several profiles and/or require one of several capabilities, e.g. as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1, not all of which are necessarily supported by a receiving decoder. As a result, decoders might attempt to process the contents only to determine that they cannot be rendered either partially or in full.

Published specification: Rec. ITU-T T.815 | ISO/IEC 15444-16

Applications: Multimedia and scientific

Fragment identifier considerations: None

Restrictions on usage: None

Additional information:

Deprecated alias names for this type: N/A

Magic number(s): None

File extension(s): hej2

Macintosh File Type Code(s): N/A

Object Identifiers: N/A

Intended usage: COMMON

Notes: None

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7 Encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 sequences

7.1 General

This clause specifies the encapsulation of a sequence of JPEG 2000 codestreams, as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1, as an image sequence, as defined in ISO/IEC 23008-12.

7.2 JPEG 2000 image sequence

A JPEG 2000 image sequence is an image sequence, as defined in ISO/IEC 23008-12, that conforms to the following:

- each visual sample entry shall be a JPEG 2000 visual sample entry, as specified in 7.3;
- each sample shall consist of one Contiguous Codestream box as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1; and
- each sample shall be a sync sample.

NOTE – The JPEG 2000 codestream contained in the Contiguous Codestream box can require capabilities not defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, including those specified in Rec. ITU-T T.814 | ISO/IEC 15444-15. Such required capabilities are signalled in the CAP Marker Segment specified in Rec. ITU-T T.800 | ISO/IEC 15444-1.

7.3 JPEG 2000 visual sample entry

7.3.1 Syntax

```
class J2KSampleEntry extends VisualSampleEntry('j2ki') {
  J2KHeaderInfo        j2kheader;
    J2KCodestreamPrefix     j2kprefix;
}
```

7.3.2 Semantics

The `width` and `height` fields shall be equal to the width and height of the image resulting from decoding the JPEG 2000 codestreams associated with the sample entry.

The displayable data of the `compressorname` field should be equal to the string of "`JPEG 2000`".

The `j2kheader` field shall apply to all the JPEG 2000 codestreams associated with the sample entry.

NOTE – The `j2kprefix` field can be used to store repetitive data stored at the beginning of all JPEG 2000 codestreams to which the sample entry applies.

7.4 JPEG 2000 prefix

7.4.1 Syntax

```
class J2KCodestreamPrefix() extends Box('j2kP'){
    int(8)[] data;
}
```

7.4.2 Semantics

The `data` field contains a sequence of bytes to be prepended to the contents of a Contiguous Codestream box before presentation to the decoder.

7.5 JPEG 2000 header info

7.5.1 Syntax

```
class J2KHeaderInfo extends Box('j2kH') {
    // same as J2KHeaderItemProperty
}
```

7.5.2 Semantics

The contents and semantics of this box are identical to those of the JPEG 2000 header item property in 6.3.

7.6 File conformance

This subclause specifies requirements for a file that conforms to the '`j2is`' brand.

The file shall conform to the '`msf1`' brand as specified in ISO/IEC 23008-12.

The file shall include '`j2is`' as a compatible brand.

The file shall contain one or more JPEG 2000 image sequences as specified in 7.2.

NOTE – This Recommendation | International Standard does not specify reader conformance for the '`j2is`' brand.

7.7 Media type

The `image/j2is` media type, as defined in 7.8, refers to content that consists of a single file that conforms to the `'j2is'` brand as specified in 7.6.

7.8 Media type registration

7.8.1 General

Many Internet protocols are designed to carry arbitrary labelled content. The mechanism used to label such content is a media type, which is defined in IETF RFC 6838 and consists of a top-level type, a subtype, and in some instances, optional parameters.

The media type specification of the following clause has a matching registration in the IANA central registry, as specified in IETF RFC 6838.

7.8.2 Registration

Type name: image

Subtype name: j2is

Required parameters: None

Optional parameters: Same as for the media type image/heif. The presence of a sample entry of type 'j2ki' is signalled by including a value whose first element is 'j2ki' in the codecs parameter.

Encoding considerations: binary

Notes: None

Security considerations: See media type image/heif. In addition, JPEG 2000 image sequences contain structures of variable length and have an extensible syntax. Both aspects present potential security risks for implementations. In particular, variable length structures present buffer overflow risks and extensible syntax could result in the triggering of adverse actions.

Interoperability considerations: Same as for the media type image/heif. In addition, JPEG 2000 codestreams can conform to one of several profiles and/or require one of several capabilities, e.g. as specified in Rec. ITU-T T.800 | ISO/IEC 15444-1 – not all of which are necessarily supported by a receiving decoder. As a result, decoders might attempt to process the contents only to determine that they cannot be rendered either partially or in full.

Published specification: Rec. ITU-T T.815 | ISO/IEC 15444-16

Applications: Multimedia and scientific

Fragment identifier considerations: None

Restrictions on usage: None

Additional information:

Deprecated alias names for this type: N/A

    Magic number(s): None

    File extension(s): j2is

    Macintosh File Type Code(s): N/A

Intended usage: COMMON

Notes: None

Contact name: ISO/IEC JTC 1/SC 29/WG 1 Convenor

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8 Encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences (informative)

The encapsulation of Rec. ITU-T T.802 | ISO/IEC 15444-3 image sequences, and corresponding media type `image/hsj2`, which are specified in the previous edition of this Recommendation | International Standard, are deprecated and not recommended for new applications. They are replaced by the encapsulation of Rec. ITU-T T.800 | ISO/IEC 15444-1 image sequences specified in clause 7.

Bibliography

– Recommendation ITU-T T.802 (in force) | ISO/IEC 15444-3 (latest version in force), *Information technology – JPEG 2000 image coding system – Motion JPEG 2000*.

– Recommendation ITU-T T.814 (in force) | ISO/IEC 15444-15 (latest version in force), *Information technology – JPEG 2000 image coding system – Part 15: High-Throughput JPEG 2000*.

– IETF RFC 6838 (BCP 13), *Media Type Specifications and Registration Procedures*.

– ISO/IEC 14496-12 (latest version in force), *Information technology – Coding of audio-visual objects – Part 12: ISO base media file format*.

– ISO/IEC 23000-22:2019, *Information technology — Multimedia application format (MPEG-A) — Part 22: Multi-image application format (MIAF)*.

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