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**Information technology — JPEG 2000  
image coding system —**

**Part 14:  
XML representation and reference**

*Technologies de l'information — Système de codage d'images  
JPEG 2000 —*

*Partie 14: Représentation et référence XML*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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.

ISO/IEC 15444-14 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. T.813 (2012).

ISO/IEC 15444 consists of the following parts, under the general title *Information technology — JPEG 2000 image coding system*:

- *Part 1: Core coding system*
- *Part 2: Extensions*
- *Part 3: Motion JPEG 2000*
- *Part 4: Conformance testing*
- *Part 5: Reference software*
- *Part 6: Compound image file format*
- *Part 8: Secure JPEG 2000*
- *Part 9: Interactivity tools, APIs and protocols*
- *Part 10: Extensions for three-dimensional data*
- *Part 11: Wireless*
- *Part 12: ISO base media file format*
- *Part 13: An entry level JPEG 2000 encoder*
- *Part 14: XML representation and reference*

## INTERNATIONAL STANDARD

## RECOMMENDATION ITU-T

# Information technology – JPEG 2000 image coding system – XML representation and reference

## 1 Scope

This Recommendation | International standard specifies an XML document, referred to as JPXML, which is designed primarily for representing JPEG 2000 file format and marker segments in the codestream, and a referring method for embedding internal data in a JPEG 2000 image.

This Recommendation | International Standard

- specifies JPXML conversion rules for general box file formats;
- specifies JPXML conversion rules for JPEG 2000 family file formats and codestream segments;
- specifies a complete referring location path to address to exact box or codestream data in an image;
- provides guidance on processes for converting source image data to an XML structural document;
- provides guidance on how to implement these processes in practice.

## 2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated 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 Recommendation | International Standards

- Recommendation ITU-T T.800 (2002) | ISO/IEC 15444-1:2004, *Information technology – JPEG 2000 image coding system: Core coding system*.
- Recommendation ITU-T T.801 (2002) | ISO/IEC 15444-2:2004, *Information technology – JPEG 2000 image coding system: Extensions*.
- Recommendation ITU-T T.802 (2005) | ISO/IEC 15444-3:2007, *Information technology – JPEG 2000 image coding system: Motion JPEG 2000*.
- Recommendation ITU-T T.805 (2012) | ISO/IEC 15444-6 (2013), *Information technology – JPEG 2000 image coding system: Compound image file format*.
- Recommendation ITU-T T.807 (2006) | ISO/IEC 15444-8:2007, *Information technology – JPEG 2000 image coding system: Secure JPEG 2000*.
- Recommendation ITU-T T.808 (2005) | ISO/IEC 15444-9:2005, *Information technology – JPEG 2000 image coding system: Interactivity tools, APIs and protocols*.
- Recommendation ITU-T T.809 (2011) | ISO/IEC 15444-10:2011, *Information technology – JPEG 2000 image coding system: Extensions for three-dimensional data*.
- Recommendation ITU-T T.810 (2006) | ISO/IEC 15444-11:2007, *Information technology – JPEG 2000 image coding system: Wireless*.
- Recommendation ITU-T T.812 (2007) | ISO/IEC 15444-13:2008, *Information technology – JPEG 2000 image coding system: Wireless*.

### 2.2 Paired Recommendations | International Standards equivalent in technical content

- Recommendation ITU-T T.832 (2009), *Information technology – JPEG XR image coding system: An entry level JPEG 2000 encoder*.  
ISO/IEC 29199-2:2009, *Information technology – JPEG XR image coding system – Part 2: Image coding specification*.

- Recommendation ITU-T T.833 (2010), *Information technology – JPEG XR image coding system – Motion JPEG XR*  
ISO/IEC 29199-3:2010, *Information technology – JPEG XR image coding system – Part 3: Motion JPEG XR*.
- ISO 12639:1998, *Graphic technology – Prepress digital data exchange – Tag image file format for image technology (TIFF/IT)*.

### 2.3 Additional references

- ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*.
- ISO/IEC 15444-12:2012, *Information technology – JPEG 2000 image coding system – Part 12: ISO base media file format*.
- IETF RFC 2045 (1996), *Multipurpose Internet Mail Extensions (MIME) Part One*.
- IETF RFC 2279 (1998), *UTF-8, A transformation format of ISO 10646*.
- IETF RFC 4648 (2006), *The Base16, Base32, and Base64 Data Encodings*.
- W3C Recommendation (2009), *Namespaces in XML 1.0 (Third Edition)*.
- W3C Recommendation (2008), *Extensible Markup Language (XML), Version 1.0 (Fifth Edition)*.
- W3C Recommendation (2004), *XML Schema Part 0: Primer*.
- W3C Recommendation (2004), *XML Schema Part 1: Structures*.
- W3C Recommendation (2004), *XML Schema Part 2: Datatypes*.
- W3C Recommendation (2010), *XML Path Language (XPath) 2.0*.

## 3 Definitions

For the purposes of this Recommendation | International Standard, the definitions given in Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.801 | ISO/IEC 15444-2 and those listed below apply. Should there be any difference between the definition given in this clause and the one given in one of the other Recommendation | International Standard cited above, the one given in this clause prevails.

- 3.1**     ...: elision mark. This mark denotes that some words or characters are erased or abbreviated.
- 3.2**     **4CC**: Four-character codes of the box type generally referred to by an ISO 646 character string translation of the integer value. This value is used for a box type that specifies its contents.
- 3.3**     **absolute offset**: Offset to internal image data from the start of an image file. By the JPXML converter, the offset will be made with "length" attributes from the top to the target elements.
- 3.4**     **box**: A sequence of byte blocks that contains its length, 4CC data type, and contents. Some boxes, such as the "jp2c" box, contain an image codestream; other boxes contain image properties such as image width and height. This data block is the atom of the JPEG 2000 and MPEG 4 image file format.
- 3.5**     **box-based format**: A sequence of boxes that contains several image properties and expresses an image file format. This image format starts with a signature box and contains at least one codestream.
- 3.6**     **box element**: A JPXML element for a box, and this element name is translated from the 4CC of the box type by using conversion rules described in clause 7.
- 3.7**     **codestream**: A sequence of bits contained in a sequence of *bytes*, created by an image coder. This data sequence contains marker segments for holding image coding properties that are parsed by a decoder or translator. This may be arranged so that the most significant bit of the first *byte* is the first bit of the *codestream*, the next most significant bit of the first *byte* is the second bit of the *codestream*, and so on, to the least significant *bytes*.
- 3.8**     **fat representation**: A JPXML document that contains whole image data on text nodes. This representation can be translated to a genuine image without any additional image information because it contains whole image information. However, because of translating whole chunk data into the XML format, this representation needs more data space than was required for the original image. For more details, see 6.1.
- 3.9**     **fat-skeleton representation**: A JPXML document that contains image properties excluding codestream chunk data. This representation may have a location path to chunk image data by using the JPXML format. This represents a box file format image structure. For more details, see 6.1.

**3.10 JPXML converter:** A converter that translates data between an image and a JPXML document. The JPXML "forward" converter translates an image to a JPXML document, and the JPXML "inverse" converter translates the edited document and codestream data to an image. These converters use rules of element name creation, defined container and undefined chunk container conversions.

**3.11 JPXML document:** An XML document that corresponds to the box file format or codestream, categorized according to included contents; skeleton, fat-skeleton and fat representations. For more details, see 6.1.

**3.12 JPXML document structure:** The structure of a JPXML element in a JPXML document, which expresses an image data structure. This structure is used for a location path using XPath expression.

**3.13 JPXML element:** An XML element represents a box file format or codestream structure, and is translated from a box, marker, or its content. The 4CC box type, marker type, and the "content" are used as this element name. For more details, see 6.2.

**3.14 location path:** The location of an internal image data using XPath expression with a JPXML document. This expression represents the absolute offset value and the JPXML document structure.

**3.15 marker element:** A JPXML element for the marker segment. This element name is translated from the marker type using the conversion rule described in 7.1 and 7.3.

**3.16 marker segment:** A binary data block in a codestream which contains the marker type and may contain marker properties for coding information.

**3.17 skeleton representation:** A JPXML document which does not contain text nodes. This only represents the structure of a box file format image. For more details, see 6.1.

## 4 Abbreviations and symbols

The abbreviations and symbols defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.801 | ISO/IEC 15444-2, Rec. ITU-T T.805 | ISO/IEC 15444-6, Rec. ITU-T T.808 | ISO/IEC 15444-9, Rec. ITU-T T.810 | ISO/IEC 15444-11, and Rec. ITU-T T.812 | ISO/IEC 15444-13 also apply to this Recommendation | International Standard.

### 4.1 Abbreviations

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

|       |                                                        |
|-------|--------------------------------------------------------|
| JPXML | Refers to this Recommendation   International Standard |
| MIME  | Multipurpose Internet Mail Extension                   |
| TIFF  | Tag Image File Format                                  |
| XML   | eXtended Metadata Language                             |
| XSLT  | XML Stylesheet Language Transformation                 |

## 5 Conventions

This Recommendation | International Standard consists of normative and informative text.

Normative text is that text which expresses mandatory requirements. The word "shall" is used to express mandatory requirements strictly to be followed in order to conform to this Specification and from which no deviation is permitted. A conforming implementation is one that fulfils all mandatory requirements.

Informative text is text that is potentially helpful to the user, but not indispensable and can be removed, changed or added editorially without affecting interoperability. All text in this Recommendation | International Standard is normative, with the following exceptions: the Introduction, any parts of the text that are explicitly labelled as "informative", and statements appearing with the preamble "NOTE" and behaviour described using the word "should". The word "should" is used to describe behaviour that is encouraged but is not required for conformance to this Specification.

The keywords "may" and "need not" indicate a course of action that is permissible in a conforming implementation.

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.

## 6 General description

The structural representation for the box-based format and the JPEG 2000 family codestreams is defined in this Recommendation | International Standard, which does not intend to make a new image file format. This image description is described with XML, and this temporary XML document is created as an intermediate image description for accessing internal data robustly and converting an image type. The following subclauses describe more details of this document.

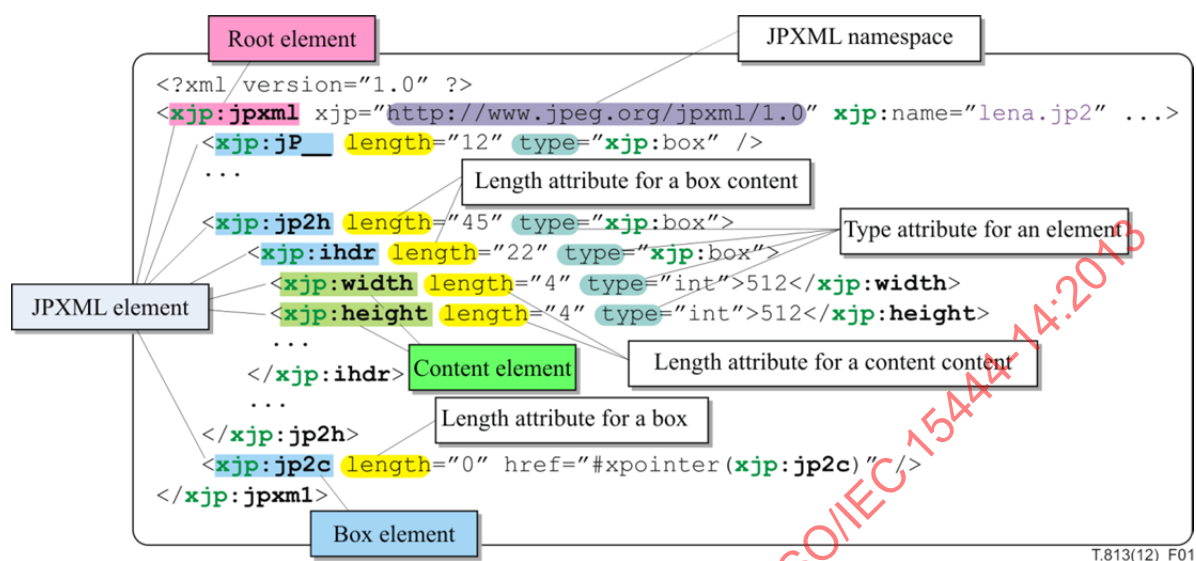


Figure 1 – Example of a JPXML document for a JPEG 2000 image

### 6.1 Structure of the JPXML document

The JPXML document is described with three elements; a JPXML element, its attribute, and its content value. The JPXML element structure represents an image structure; box, marker segment, and content structure. This document namespace shall be "http://www.iso.org/jpeg/jpxml/1.0", and this document's root element name shall be 'jpxml'. The JPXML element has two types; the first element is a container element which expresses a box or a marker segment itself, and the second one is a content element which expresses a container's property or a box content. Some containers, such as a superbox, contain other containers, and so a JPXML document will have a tree structure. Each JPXML element shall have 'length' and 'type' attributes, and these attributes denote the byte length and data type of each data chunk, respectively. The content value may be described with text, and its data type denoted with 'type' attribute. Figure 1 is an example of a JPXML document for a JPEG 2000 file format.

The container element name, or the box or marker element name, shall be created with the 4CC box type or the segment marker name, respectively, and the converting rules are described in clause 7. The container element may contain some content elements, which are optional in the JPXML document. There may be only one content element even if a container has several data containers, and this content element type attribute should be a "hexbyte" or "unknown" type. This element name shall be "content" or a name predefined in this Recommendation | International Standard. The attributes in the JPXML elements are used for creating an absolute offset from a location path for indicating chunk data in the image. The detail of this process is described in 7.5.

The box described in Rec. ITU-T T.800 | ISO/IEC 15444-1 and the JPXML document for box format are illustrated in Figure 2. Figures 2 (a), (b) and (c) are illustrations of box format structures; normal box, box with extended length and superbox, and documents (d), (e) and (f) represent the (a), (b) and (c) box structure, respectively. The superbox element shall have whole children box and superbox elements. All box elements with an extended length have a length element for storing the actual box length.

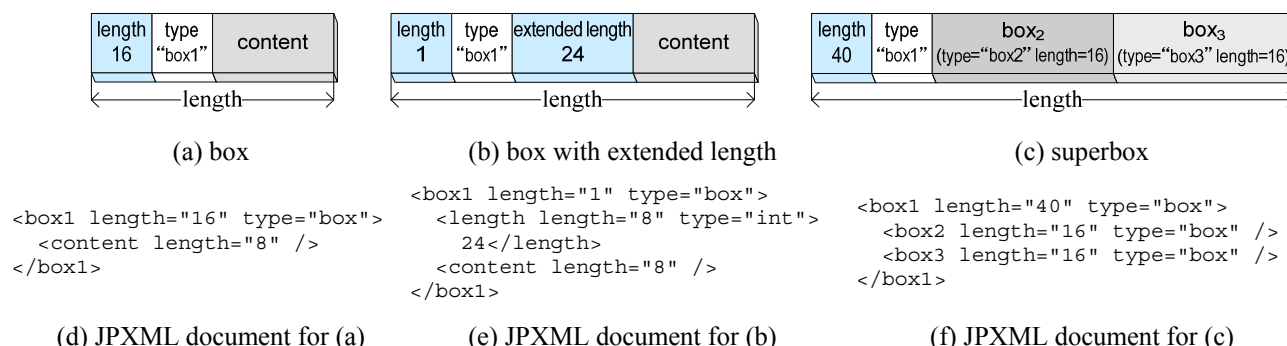


Figure 2 – Examples of box format and JPXML documents

The JPXML document is generated from an image file format and/or codestreams, and its kind varies from none property to including codestream data representations. When kinds of image property representation are included, the JPXML document is categorized with three levels of representation: "skeleton", "fat-skeleton", and "fat" representations.

The first-level representation, the skeleton representation, shall express only the structure of the image itself, and may contain an attribute for the absolute offset or the location path to the element block. The skeleton shall have no text node in the JPXML elements. This representation is used for a location path that is comparatively robust for changing the box structure of the image and/or marker segment structure of the codestream.

The second-level representation, the fat-skeleton representation, expresses the image structure and some variables of box and/or marker contents. The fat skeleton is an intermediate representation between skeleton and fat representations. Consequently, it also has the skeleton's attribute and the same text node value of JPXML elements, but no binary data (such as a coded codestream). This representation is used for a location path and also some image transformation with XSLT.

The third-and final level representation, the fat representation, expresses the image structure and whole image property values. This whole property may represent a binarized format for use of some applications, such as secure purpose. The binarized contents are translated with MIME's base64 encoding. As this representation requires more data space than the original image data, it is unsuited for use in a storage file format for image data.

## 6.2 Creation of a JPXML document

A JPXML document is created from a box-based format and/or a JPEG 2000 codestream. This generation process may consist of several steps. Figure 3 is an illustration of a block diagram of an image conversion system using the JPXML, and includes forward and inverse JPXML generators. This example consists of a forward JPXML generator, an image edit tool, and an inverse JPXML generator. The processes of forward and inverse JPXML generators may consist of two modules: a JPXML document generator and a location path generator. The JPXML document generator converts between a binary image and an XML document, and the location path generator converts between an absolute offset number to target data and an XPath location path for a target element.

For creating a JPXML document, the forward JPXML document generator uses several rules: the common conversion rule and the three element name rules. The common conversion rule is defined in 7.1. The document element name rules are for a box format, a marker segment, and a tagged image format. The inverse JPXML document generator uses the inverse rules of the forward converter's rules.

The element name rule for the box-based format creates an element name related to the four-character code (4CC) identifying the box container type. Not all 4CC values are allowable for an XML element name, such as an 'xml' and space character, and these 4CC values are modified for an XML element by using the conversion rules defined in 7.2. The details of the box-based format and four-character code are defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.801 | ISO/IEC 15444-2, Rec. ITU-T T.802 | ISO/IEC 15444-3, Rec. ITU-T T.805 | ISO/IEC 15444-6, Rec. ITU-T T.807 | ISO/IEC 15444-8, Rec. ITU-T T.808 | ISO/IEC 15444-9, Rec. ITU-T T.833 | ISO/IEC 29199-3 and ISO/IEC 15444-12. The element names are defined in Annex A.

The element name rule for the marker segment creates an element name related to a two-byte code or a marker segment name identifying the marker segment which is defined in Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.801 | ISO/IEC 15444-2, Rec. ITU-T T.807 | ISO/IEC 15444-8, Rec. ITU-T T.809 | ISO/IEC 15444-10, and Rec. ITU-T T.810 | ISO/IEC 15444-11. The two-byte code, non-character and invisible value, is converted to a visible code value for use as an XML element name by using conversion rules defined in 7.3. The details of these element names are defined in Annex B.

The element name rule for the tagged image format creates an element name related to the two byte code of the tag value identifying the tagged maker property which is defined in ISO 12639 and Rec. ITU-T T.832 | ISO/IEC 29199-2. The two byte code, non-character and invisible value, used in the TIFF image and JPEG XR, is converted to a visible code value for use as an XML element name by using conversion rules defined in 7.4.

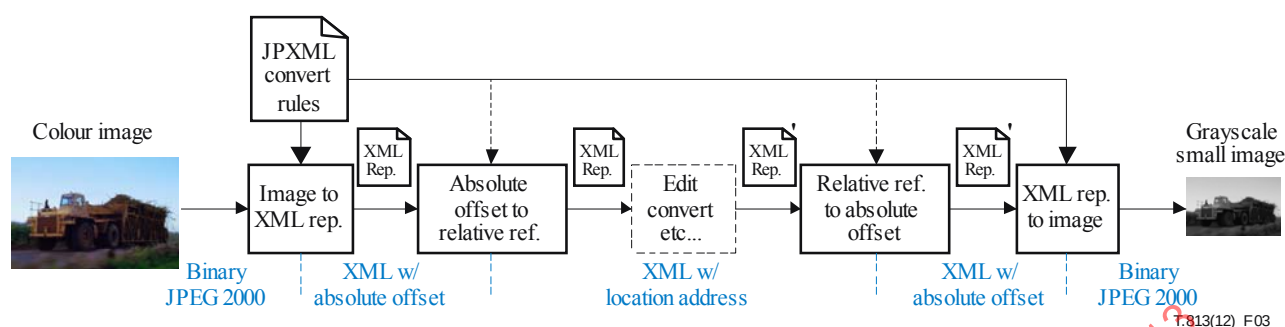
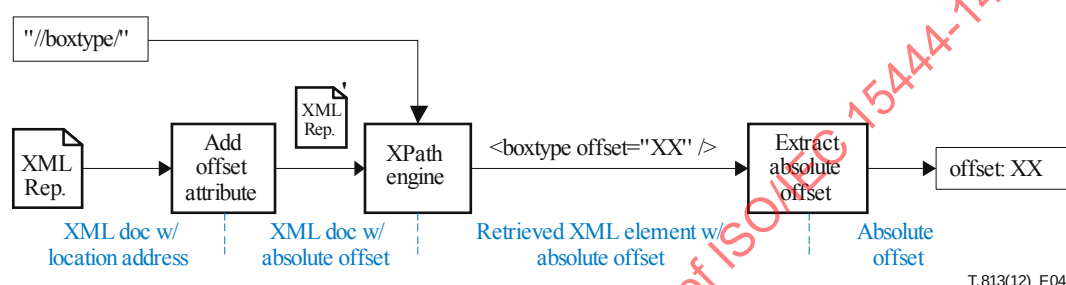


Figure 3 – Block diagram of image converting with JPXML



```

1: <box1 length="39" type="box" offset="0">
2:   <box2 length="11" type="box" offset="8">
3:     <content length="3" type="int" offset="16" />
4:   </box2>
5:   <box3 length="20" type="box" offset="19">
6:     <param1 length="4" type="int" offset="27" />
7:     <param2 length="2" type="short" offset="31" />
8:     <param3 length="2" type="short" offset="33" />
9:     <param4 length="4" type="int" offset="35" />
10:   </box3>
11: </box1>

```

(b) Part of a pseudo JPXML document with an offset attribute for the (a) format

```

1: <box3 length="16" type="box" offset="19">
2:   <content length="12" type="hexBinary" offset="27" />
3: </box3>

```

(c) Another representation of the box3 element in the (b) document (single-content representation)

Figure 5 – Example of JPXML document accessing

## 7 Document creation rules

The conversion rules between the JPXML document and the image consist of three parts: the first part is a common conversion rule for file formats and codestreams, the second part is a conversion rule between 4CC and XML element names, and the third part is a conversion rule between marker segment names and XML element names.

### 7.1 Common rule

All JPXML forward converters shall use the following common forward rules for JPXML conversion. The boxes within a superbox shall be represented in JPXML form when these rules are used for a file format forward conversion. An 'offset' attribute value shall be converted to a location path by using a JPXML document structure.

- 1) The namespace of the JPXML document shall be "http://www.iso.org/jpeg/jpxml/1.0".
- 2) The 'jpxml' shall be used for the JPXML root element, representing one file format or codestream.
- 3) The root element may have a 'name' attribute for identifying an image name.
- 4) All elements shall have 'length' and 'type' attributes, representing data byte length and type respectively.
- 5) The 'type' attributes value for the box or marker element shall be 'box' or 'marker' respectively.
- 6) A box element with length=1 attribute shall have a length element, representing the data length in byte.
- 7) All element may have an 'offset' attribute, representing the absolute offset to the data chunk in byte.
- 8) The box element shall have several box elements when the original box has a box inside its content.
- 9) The element of a box or marker segment may have content elements for representing its properties.
- 10) The predefined element names defined in later annexes shall be used for element names.
- 11) The box or marker parameters may be represented in XML form, defined in later annexes, and stored in the JPXML box or marker element.
- 12) The box or marker parameters may be represented as base64 binary, and stored in the box or marker element.

All JPXML inverse converters shall use the following common inverse rules for JPXML conversion. A box element having one or more box elements shall be converted to a superbox when reconstructing a file format. If an 'offset' attribute value is the location path using a JPXML document structure, this location path shall be converted to an absolute offset value, and stored in its element attribute.

- 1) The JPXML document shall have namespace of "http://www.iso.org/jpeg/jpxml/1.0".
- 2) The 'jpxml' root element shall be converted to one file format or codestream.
- 3) The 'name' attribute value in the root element shall be used for a file name.
- 4) The 'length' and 'type' attribute values shall be used for converted data length and type respectively.
- 5) The element having 'box' or 'marker' type shall be converted to a box or marker segment respectively.

- 6) The node value of the length element in the box element with length=1 attribute shall be used for its converted data chunk length.
- 7) The 'offset' attribute value may be used for its converted data chunk location in the image.
- 8) All box elements in the box shall be converted into the box content.
- 9) All child elements in a box or marker element shall be converted into internal contents of the data chunk.
- 10) All content element shall be combined to a binary data of the parent element.
- 11) The JPXML content elements defined in later annexes shall be converted to binary data and stored in one of the parent contents of the box or maker.
- 12) The JPXML content in base64 binary shall be converted to a binary data with the base64 converter and stored in one of the parent contents of the box or maker.

Table 1 – Example of 4CC box type conversions

| Box name                | Box type   | Hex decimal | JPXML element name |
|-------------------------|------------|-------------|--------------------|
| JPEG 2000 Signature box | jp\040\040 | 0x6A50 2020 | jp__               |
| JP2 Header box          | jp2h       | 0x6A70 3268 | jp2h               |
| Resolution box          | url\040    | 0x7572 6C20 | url__              |
| URL box                 | res\040    | 0x7265 7320 | res__              |
| XML box                 | xml\040    | 0x786D 6C20 | _xml__             |

## 7.2 Element name rule for box format

The JPXML forward converter for file formats translates a box-based format to a JPXML document, and shall use the following forward conversion rule for the 4CC:

- 1) The JPXML element name shall use a 4CC box type.
- 2) The alphanumeric characters in 4CC box type shall be directly used for the element name.
- 3) The space, '\040' code, shall be represented with a '\_' character for the JPXML element name.
- 4) The code '.HH' (H: hexadecimal character = 0, ..., 9, A, ..., F) shall be used for any other characters.
- 5) The '\_' character at the first character of the element name shall be the escape character.

The JPXML inverse converter to file formats translates a JPXML document to a box-based format, and shall use the following inverse conversion rule for the 4CC:

- 1) The JPXML element name shall be converted to a 4CC box type, and creates its type box.
- 2) The '\_' character at the first character of the element name may not be removed from the 4CC box type.
- 3) The alphanumeric name shall be directly used for the 4CC box type.
- 4) The '\_' character in the element name space shall be represented with a '\040' code for the 4CC.
- 5) The '.HH' string in the name shall be converted to a '0xHH' code character.

## 7.3 Element name rule for a tagged image format

The JPXML forward converter for tagged image file formats, translates a tag value in a directory entry to a JPXML document element name and shall use the following forward conversion rule.

- 1) The two bytes tag value shall be represented as the four characters hex string notation, 'HHHH' (H: hexadecimal character = 0, ..., 9, A, ..., F).
- 2) The '\_' character shall be placed at the front of the four character string, and creates a five characters string ('\_HHHH').

The JPXML inverse converter to tagged image file formats translates a JPXML document name to a tag value in a directory entry, and shall use the following inverse conversion rule for the 4CC.

- 1) The first '\_' character shall be removed from the five-character string, and shall create a four-character string.
- 2) The four character-string, 'HHHH' shall be converted to a '0xHHHH' code value

## 7.4 Element name rule for a marker segment

The JPXML forward converter for marker segments translates JPEG 2000 marker segments to a JPXML document, and shall use the following forward conversion rule.

- 1) The marker symbol name shall be used for a JPXML codestream element name, or the forward conversion rule for a tagged image file format shall be used for converting the marker symbol code to an element name.

The JPXML inverse converter to marker segments translates a JPXML document to JPEG 2000 marker segments, and shall use the following inverse conversion rule.

- 1) All elements named with its marker symbol name shall be converted to its named marker symbol code.
- 2) All elements with a name starting with a '\_' character of the five-character string shall be converted to the marker symbol code by using the inverse conversion rule for the tagged image file format.

**Table 2 – Example of codestream marker conversions**

| Codestream marker name | Symbol name | Code   | JPXML element name |
|------------------------|-------------|--------|--------------------|
| Start of codestream    | SOC         | 0xFF4F | SOC                |
| Start of tile-part     | SOT         | 0xFF90 | SOT                |
| Start of data          | SOD         | 0xFF93 | SOD                |
| End of codestream      | EOC         | 0xFFD9 | EOC                |
| Start of packet        | SOP         | 0xFF91 | SOP                |

## 7.5 Element type attributes

All elements have a type attribute which identifies the data type of the element content data. This Recommendation | International Standard defines uses of six data types: box, marker, fourcc, location, hexbyte, and integer and time. The integer and time data types are used for the element content data type as integer and time types, respectively, and these data types are defined in the XML schema Part 2 Recommendation. The box and marker data types are used to identify the box element and the marker element, respectively. The fourcc data type indicates the element content data that shall be the 4CC data type, and the 4CC value will not be converted with the rules previously described. The location indicates that the elements can have any location type value. The hexbyte indicates that the element data may be represented as a hexadecimal value in big-endian order. The XML definitions for the box, marker, fourcc, location and hexbyte data types can be defined by the following XML schema's simple type data type definitions:

```
<xs:simpleType name="box">
  <xs:restriction base="xs:string" />
</xs:simpleType>

<xs:simpleType name="marker">
  <xs:restriction base="xs:string" />
</xs:simpleType>

<xs:simpleType name="fourcc">
  <xs:restriction base="xs:string">
    <xs:pattern value="[a-zA-Z0-9]{4}" />
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="location">
  <xs:restriction base="xs:anyURL" />
</xs:simpleType>

<xs:simpleType name="hexbyte">
  <xs:restriction base="xs:string">
    <xs:pattern value="([a-f0-9][a-f0-9])+" />
  </xs:restriction>
</xs:simpleType>
```

## 8 Accessing image data

The XML location path and the JPXML document can be used to access internal binary chunk data in the image data. The following three steps access the internal binary data: the first step identifies the target element by using the location path and the JPXML document, the second step converts the target element to an absolute offset, and the third and final step accesses the internal image data with the target absolute offset position. To achieve the second step, the following rules are employed.

### 8.1 Rules for location conversion

The following conversion rules are for calculating an absolute offset of the target chunk from the location path point to the target element, which corresponds to the offset. To comply with these rules, there may be two approaches for calculation of the target absolute offset value; the target to root approach and the root to target approach.

- 1) The absolute offset shall be the sum of length attribute values between the top and the target elements, except for the following elements.
- 2) For the superbox child elements, the value 8 shall be used for offset counting instead of the superbox length attribute value.
- 3) The length of the child boxes contained in the parent box, ending at the beginning of the target box, will not be used for offset counting, and the length of the parent box is used for counting.

Figures 6 and 7 are illustrations of two examples of an algorithm for calculating the absolute offset value from the target element using these rules. In these algorithms, the root element shall not be used as target element, because the root element is not part of the image data. The first algorithm calculates all element nodes from the target to the root elements, and the second algorithm calculates all element nodes from the first child of the root to the target elements.

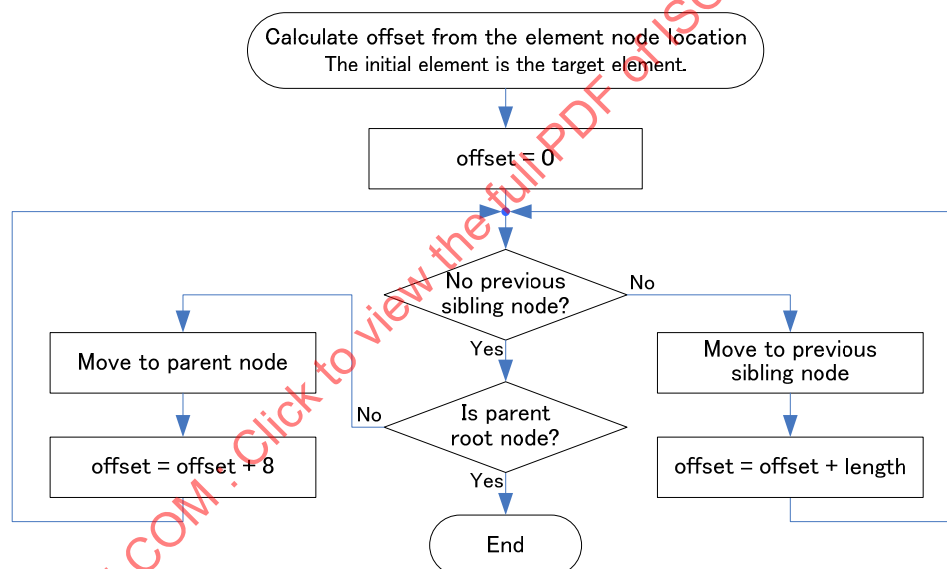


Figure 6 – Example 1 of an algorithm for calculating an offset value from the target element

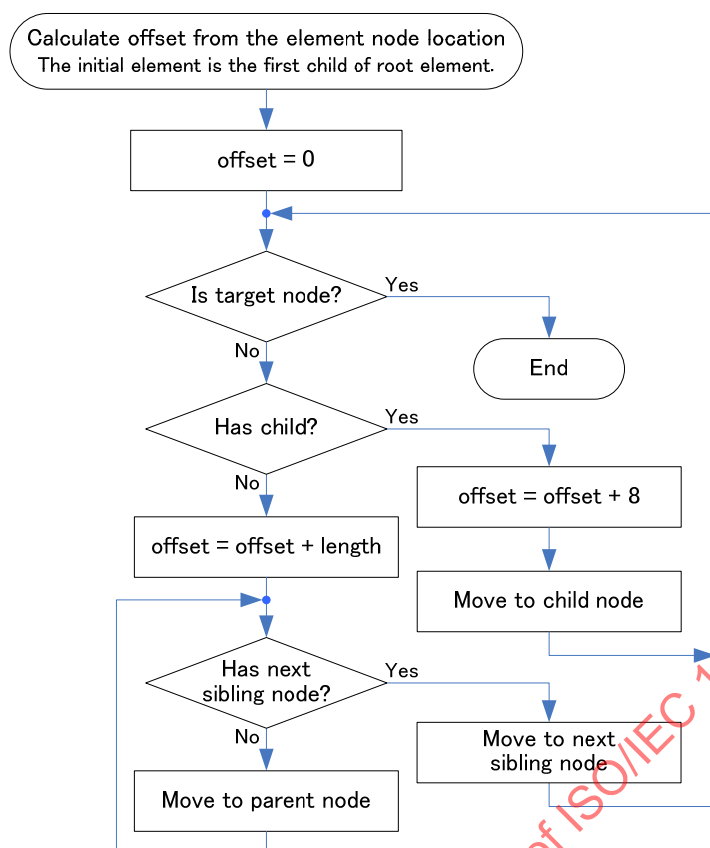


Figure 7 – Example 2 of an algorithm for calculating an offset value from the target element

## 8.2 Example of location conversion

Figure 8 shows an example of offset calculations for a pseudo JPXML document. The third and fourth columns, labelled "offset 1" and "offset 2", are the result of the target to root approach and the root to target approach, respectively. Their values are calculated by the algorithms depicted in Figures 6 and 7, respectively. In this figure, the offset 1,  $a+b+d+8$ , for the "BoxH" box is not the same as the offset 2,  $a+b+f+g+24$ . However, the "BoxD" box length,  $d$ , is the same as the summation of its content and header lengths,  $f+g+16$ , and so these offsets have identical value.

| Line | Pseudo JPXML document                | offset 1     | offset 2           |
|------|--------------------------------------|--------------|--------------------|
| 1    | <jpxml ... >                         |              |                    |
| 2    | <BoxA length="a" type="box" />       | 0            | 0                  |
| 3    | <BoxB length="b" type="box" />       | a            | a                  |
| 4    | <BoxC length="c" type="box">         | a+b          | a+b                |
| 5    | <BoxD length="d" type="box">         | a+b+8        | a+b+8              |
| 6    | <BoxE length="e" type="box">         | a+b+16       | a+b+16             |
| 7    | <BoxF length="f" type="box" />       | a+b+24       | a+b+24             |
| 8    | <BoxG length="g" type="box" />       | a+b+f+24     | a+b+f+24           |
| 9    | </BoxE>                              |              |                    |
| 10   | </BoxD>                              |              |                    |
| 11   | <BoxH length="h" type="box" />       | a+b+d+8      | a+b+f+g+24         |
| 12   | </BoxC>                              |              |                    |
| 13   | <BoxI length="i" type="box" />       | a+b+c        | a+b+f+g+h+24       |
| 14   | <BoxJ length="j" type="box">         | a+b+c+i      | a+b+f+g+h+i+24     |
| 15   | <BoxK length="k" type="box" />       | a+b+c+i+8    | a+b+f+g+h+i+32     |
| 16   | <BoxL length="l" type="box">         | a+b+c+i+k+8  | a+b+f+g+h+i+k+32   |
| 17   | <length length="8" type="integer" /> | a+b+c+i+k+16 | a+b+f+g+h+i+k+40   |
| 18   | <BoxM length="m" type="box" />       | a+b+c+i+k+24 | a+b+f+g+h+i+k+48   |
| 19   | </BoxL>                              |              |                    |
| 20   | </BoxJ>                              |              |                    |
| 21   | </BoxN length="n" type="box" />      | a+b+c+j      | a+b+f+g+h+i+k+m+48 |
| 22   | </jpxml>                             |              |                    |

Figure 8 – Example of offsets generated for a pseudo JPXML document

## Annex A

## JPXML elements for box file format

(This annex forms an integral part of this Recommendation | International Standard.)

## A.1 Introduction

This annex provides the content element name definitions, and length and type attributes for JPEG 2000 family formats. The box element appearance and structure shall be in conformity with Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.801 | ISO/IEC 15444-2, Rec. ITU-T T.802 | ISO/IEC 15444-3, Rec. ITU-T T.805 | ISO/IEC 15444-6, Rec. ITU-T T.807 | ISO/IEC 15444-8, Rec. ITU-T T.808 | ISO/IEC 15444-9 and ISO/IEC 15444-12.

## A.2 Box element definitions

This subclause includes many tables of the box content element definitions, and these tables define the content element name, the content data length in bytes, and the content data type. The JPXML data types are described in 7.5. Some tables define the sub-content element names of a defined content element, and some box or content elements have content element definitions of two or more types. For more detailed information of the meaning and structure of box content, refer to Recommendations | International Standards listed in A.1.

## A.2.1 Still picture format definitions

The box file formats defined in Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.801 | ISO/IEC 15444-2 are designed to represent a still picture image. Table A.1 illustrates element structures of these file formats. These content element names and types are defined in the following tables.

Table A.1 – Box element structure for a still image

| Element name | Box name                                | Part 1   | Part 2   | Defined  |
|--------------|-----------------------------------------|----------|----------|----------|
| jp_          | JPEG family signature box               | required | required | 1        |
| ftyp         | File type and compatibility box         | required | required | 1        |
| rreq         | Reader requirement box                  |          | required | 2        |
| jp2h         | JP2 header box (superbox)               | required | optional | 1, 2     |
| lbl_         | Label box                               |          | optional | 2        |
| ihdr         | Image header box                        | required | required | 1, 2, 6  |
| bpc          | Bits per component box                  | optional | optional | 1, 2     |
| colr         | Colour specification box                | required | required | 1, 2, 6  |
| pclr         | Palette box                             | optional | optional | 1        |
| cmap         | Component mapping box                   | optional | optional | 1        |
| cdef         | Channel description box                 | optional | optional | 1        |
| res_         | Resolution box (superbox)               | optional | optional | 1        |
| resc         | Capture resolution box                  | optional | optional | 1        |
| resd         | Display resolution box                  | optional | optional | 1        |
| jpch         | Codestream header box (superbox)        |          | optional | 2        |
| lbl_         | Label box                               |          | optional | 2        |
| ihdr         | Image header box                        |          | required | 1, 2, 6  |
| bpc          | Bits per component box                  |          | optional | 2        |
| pclr         | Palette box                             |          | optional | 1        |
| cmap         | Component mapping box                   |          | optional | 1        |
| jplh         | Compositing layer header box (superbox) |          | optional | 2        |
| lbl_         | Label box                               |          | optional | 2        |
| cgrp         | Colour group box (superbox)             |          | optional | 2        |
| colr         | Colour specification box                |          | optional | 1, 2, 6  |
| opct         | Opacity box (superbox)                  |          | optional | 1, 2     |
| cdef         | Channel description box                 |          | optional | 1        |
| creg         | Codestream registration box             |          | optional | 2        |
| pxfm         | Pixel format box                        |          | optional | 2        |
| res_         | Resolution box (superbox)               |          | optional | 1        |
| dtbl         | Data reference box                      |          | optional | 2, 6, 12 |
| ftbl         | Fragment table box (superbox)           |          | optional | 2, 6     |

Table A.1 – Box element structure for a still image

| Element name | Box name                               | Part 1   | Part 2   | Defined  |
|--------------|----------------------------------------|----------|----------|----------|
| flst         | Fragment list box                      |          | optional | 2, 6     |
| jp2c         | Contiguous codestream box              | required | optional | 1, 2, 6  |
| mdat         | Metadata box                           |          | optional | 2        |
| comp         | Composition box                        |          | optional | 2        |
| copt         | Composition options box                |          | optional | 2        |
| inst         | Instruction set box                    |          | optional | 2        |
| drep         | Desired reproductions box (superbox)   |          | optional | 2        |
| gtso         | Graphics technical standard output box |          | optional | 2        |
| roid         | ROI description box                    |          | optional | 2        |
| cref         | Cross reference box (superbox)         |          | optional | 2, 6     |
| flst         | Fragment list box                      |          | optional | 2, 6     |
| asoc         | Association box (superbox)             |          | optional | 2        |
| dxml         | Decomposed XML box                     |          | optional | 2        |
| nlst         | Number list box                        |          | optional | 2        |
| lbl_         | Label box                              |          | optional | 2        |
| bfil         | Binary filter box                      |          | optional | 2        |
| chck         | Digital signature box                  |          | optional | 2        |
| mp7b         | MPEG-7 binary box                      |          | optional | 2        |
| free         | Free space box                         |          | optional | 2        |
| _xml_        | XML container box                      | optional | optional | 1, 2, 12 |
| jp2i         | IPR box                                | optional | optional | 1        |
| uuid         | UUID box                               | optional | optional | 1        |
| uinf         | UUID information box (superbox)        | optional | optional | 1        |
| ulst         | UUID list box                          | optional | optional | 1        |
| url_         | Data entry box                         | optional | optional | 1        |
| jclx         | Compositing layer extensions box       |          | optional | 2        |
| jlx_i        | Compositing layer extensions info box  |          | optional | 2        |
| j2cx         | Multiple codestream box                |          | optional | 2        |
| j2ci         | Multiple codestream info box           |          | optional | 2        |
| grp_         | Grouping box                           |          | optional | 2        |

## A.2.1.1 Box element definitions for JPEG 2000 Part 1 format

Table A.2 – Content element name for jp\_

| content   | length | type    | loop |
|-----------|--------|---------|------|
| signature | 12     | hexbyte |      |

Table A.3 – Content element name for ftyp

| content       | length | type    | loop |
|---------------|--------|---------|------|
| brand         | 4      | fourcc  |      |
| version       | 4      | integer |      |
| compatibility | 4      | fourcc  | 1    |

Table A.4 – Content element name for jp2h

| content | length   | type | loop |
|---------|----------|------|------|
| ihdr    | –        | box  | =1   |
| bpcc    | optional | box  | ≤1   |
| colr    | –        | box  | ≥1   |
| pclr    | optional | box  | ≥0   |
| cmap    | optional | box  | ≤1   |
| cdef    | –        | box  | ≤1   |
| res_    | –        | box  | ≤1   |

Table A.5 – Content element name for ihdr

| content        | length | type    | loop |
|----------------|--------|---------|------|
| height         | 4      | integer |      |
| width          | 4      | integer |      |
| num_components | 2      | integer |      |
| depth          | 1      | integer |      |
| compression    | 1      | integer |      |
| colour_unknown | 1      | integer |      |
| ipr            | 1      | integer |      |

Table A.6 – Content element name for colr

| Content    | length | type    | loop |
|------------|--------|---------|------|
| method     | 1      | integer |      |
| precedence | 1      | integer |      |
| approx     | 1      | integer |      |
| colour     | ≥4     | hexbyte |      |

**Table A.7 – Content element name for bpcc**

| content | length | type    | loop |
|---------|--------|---------|------|
| depth   | 1      | integer | 1    |

**Table A.8 – Content element name for pclr**

| content        | length      | type    | loop |
|----------------|-------------|---------|------|
| num_entries    | 2           | integer |      |
| num_components | 1           | integer |      |
| depth          | 1           | integer | 1    |
| data           | num_entries | hexbyte | 1    |

**Table A.9 – Content element name for cdef**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| num_entries | 2      | integer |      |
| index       | 2      | integer | 1    |
| type        | 2      | integer |      |
| assoc       | 2      | hexbyte |      |

**Table A.10 – Content element name for res\_**

| content | length | type | loop |
|---------|--------|------|------|
| resc    | –      | box  | ≤1   |
| resd    | –      | box  | ≤1   |

**Table A.11 – Content element name for resc and resd**

| content  | length | type    | loop |
|----------|--------|---------|------|
| vert_num | 2      | integer |      |
| vert_den | 2      | integer |      |
| hori_num | 2      | integer |      |
| hori_den | 2      | integer |      |
| vert_exp | 2      | integer |      |
| hori_exp | 2      | integer |      |

**A.2.1.2 Box element definitions for JPEG 2000 part 2 format****Table A.18 – Content element name for rreq**

| content             | length | type    | loop |
|---------------------|--------|---------|------|
| length              | 1      | integer |      |
| fua_mask            | length | hexbyte |      |
| dc_mask             | length | hexbyte |      |
| num_std_flags       | 2      | integer |      |
| std_flag            | 2      | integer | 1    |
| std_mask            | length | hexbyte |      |
| num_vender_features | 2      | integer |      |
| vender_feature      | 16     | integer | 1    |
| vender_mask         | length | hexbyte |      |

**Table A.19 – Content element name for dtbl**

| content     | length   | type     | loop |
|-------------|----------|----------|------|
| num_entries | 2        | integer  |      |
| location    | variable | location |      |

**Table A.12 – Content element name for uuid**

| content | length   | type    | loop |
|---------|----------|---------|------|
| id      | 16       | integer |      |
| data    | 0-65,531 | hexbyte |      |

**Table A.13 – Content element name for uinf**

| content | length | type | loop |
|---------|--------|------|------|
| ulst    | –      | box  | =1   |
| url_    | –      | box  | =1   |

**Table A.14 – Content element name for ulst**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| num_entries | 2      | integer |      |
| data        | 16     | hexbyte | 1    |

**Table A.15 – Content element name for url\_**

| content  | length   | type     | loop |
|----------|----------|----------|------|
| location | 0-65,531 | location |      |

**Table A.16 – Content element name for \_xml\_**

| content | length   | type   | loop |
|---------|----------|--------|------|
| text    | 0-65,531 | string |      |

**Table A.17 – Content element name for jp2c**

| content | length | type    | loop |
|---------|--------|---------|------|
| data    | ≥0     | hexbyte |      |

**Table A.20 – Content element name for lbl\_**

| content | length   | type   | loop |
|---------|----------|--------|------|
| label   | variable | string |      |

**Table A.21 – Content element name for mp7b**

| content | length   | type    | loop |
|---------|----------|---------|------|
| mpeg7   | variable | hexbyte |      |

**Table A.22 – Content element name for ftbl**

| content | length | type | loop |
|---------|--------|------|------|
| flst    | –      | box  | ≥0   |

**Table A.23 – Content element name for free**

| content | length   | type    | loop |
|---------|----------|---------|------|
| data    | 0-65,531 | hexbyte |      |

**Table A.24 – Content element name for flst**

| content        | length | type    | loop |
|----------------|--------|---------|------|
| num_entries    | 2      | integer | ]    |
| offset         | 8      | integer |      |
| length         | 4      | integer |      |
| data_reference | 2      | integer |      |

**Table A.25 – Content element name for cref**

| content | length | type    | loop |
|---------|--------|---------|------|
| type    | 4      | integer | =1   |
| flst    | —      | box     | =1   |

**Table A.26 – Content element name for jpch**

| content | length | type | loop |
|---------|--------|------|------|
| lbl_    | —      | box  | ≥0   |
| ihdr    | —      | box  |      |
| bpcc    | —      | box  |      |
| pclr    | —      | box  |      |
| cmap    | —      | box  |      |
| roid    | —      | box  |      |

**Table A.27 – Content element name for jplh**

| content | length | type | loop |
|---------|--------|------|------|
| lbl_    | —      | box  | ≥0   |
| cgrp    | —      | box  | ≥0   |
| opct    | —      | box  | ≥0   |
| cdef    | —      | box  | ≥0   |
| creq    | —      | box  | ≥0   |
| res_    | —      | box  | ≤1   |

**Table A.28 – Content element name for cgrp**

| content | length   | type | loop |
|---------|----------|------|------|
| colr    | 0-65,531 | box  | ≥1   |

**Table A.29 – Content element name for colour**

| colour      | length   | type    | loop |
|-------------|----------|---------|------|
| enum_colour | 4        | integer |      |
| enum_param  | variable | hexbyte |      |

| colour        | length   | type    | loop |
|---------------|----------|---------|------|
| vender_colour | 16       | integer |      |
| vender_param  | variable | hexbyte |      |

**Table A.30 – Content element name for enum\_param**

| enum_param | length | type    | loop |
|------------|--------|---------|------|
| range_L    | 4      | integer |      |
| offset_L   | 4      | integer |      |
| range_a    | 4      | integer |      |
| offset_a   | 4      | integer |      |
| range_b    | 4      | integer |      |
| offset_b   | 4      | integer |      |
| illuminant | 4      | integer |      |

| enum_param | length | type    | loop |
|------------|--------|---------|------|
| range_J    | 4      | integer |      |
| offset_J   | 4      | integer |      |
| range_a    | 4      | integer |      |
| offset_a   | 4      | integer |      |
| range_b    | 4      | integer |      |
| offset_b   | 4      | integer |      |

**Table A.31 – Content element name for opet**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| type        | 1      | integer |      |
| num_entries | 1      | integer |      |
| data        | 1      | integer | ]    |

**Table A.32 – Content element name for drep**

| content | length | type | loop |
|---------|--------|------|------|
| gtso    |        | box  |      |

**Table A.33 – Content element name for gtso**

| content | length   | type    | loop |
|---------|----------|---------|------|
| profile | variable | hexbyte |      |

**Table A.34 – Content element name for creg**

| content         | length | type    | loop |
|-----------------|--------|---------|------|
| hori_size       | 2      | integer |      |
| vert_size       | 2      | integer |      |
| cds_num         | 2      | integer |      |
| hori_resolution | 1      | integer |      |
| vert_resolution | 1      | integer |      |
| hori_offset     | 1      | integer |      |
| vert_offset     | 1      | integer |      |

**Table A.35 – Content element name for comp**

| content | length | type | loop |
|---------|--------|------|------|
| copt    | —      | box  | =1   |
| inst    | —      | box  |      |

**Table A.36 – Content element name for copt**

| content | length | type    | loop |
|---------|--------|---------|------|
| height  | 4      | integer |      |
| width   | 4      | integer |      |
| loop    | 1      | integer |      |

**Table A.37 – Content element name for inst**

| content     | length   | type    | loop |
|-------------|----------|---------|------|
| type        | 2        | integer |      |
| repetition  | 2        | integer |      |
| duration    | 1        | integer |      |
| instruction | variable | hexbyte |      |

Table A.38 – Content element name for instruction

| instruction      | length | type    | loop |
|------------------|--------|---------|------|
| hori_offset      | 0, 4   | integer |      |
| vert_offset      | 0, 4   | integer |      |
| width            | 0, 4   | integer |      |
| height           | 0, 4   | integer |      |
| life             | 0, 4   | integer |      |
| next_use         | 0, 4   | integer |      |
| hori_crop_offset | 0, 4   | integer |      |
| vert_crop_offset | 0, 4   | integer |      |
| crop_width       | 0, 4   | integer |      |
| crop_height      | 0, 4   | integer |      |

Table A.39 – Content element name for roid

| content     | length | type    | loop |
|-------------|--------|---------|------|
| num_entries | 1      | integer |      |
| contained   | 1      | integer |      |
| type        | 1      | integer |      |
| priority    | 1      | integer |      |
| left        | 4      | integer |      |
| top         | 4      | integer |      |
| width       | 4      | integer |      |
| height      | 4      | integer |      |

Table A.40 – Content element name for asoc

| content         | length | type | loop |
|-----------------|--------|------|------|
| Association box | –      | box  | =1   |
| Associated box  | –      | box  | ⌋    |

Table A.41 – Content element name for nlst

| content  | length | type    | loop |
|----------|--------|---------|------|
| asoc_num | 4      | integer | ⌋    |

Table A.42 – Content element name for bfil

| content | length   | type    | loop |
|---------|----------|---------|------|
| type    | 16       | integer |      |
| data    | variable | hexbyte |      |

Table A.43 – Content element name for chck

| content        | length | type    | loop |
|----------------|--------|---------|------|
| signature_type | 1      | integer |      |
| source_type    | 1      | integer |      |
| offset         | 0, 8   | integer |      |
| length         | 0, 8   | integer |      |
| data           | length | hexbyte |      |

### A.2.2 Definitions of motion picture format

The box file formats defined in Rec. ITU-T T.802 | ISO/IEC 15444-3 and ISO/IEC 15444-12 are designed to represent a motion picture image. Table A.44 is the box element and element structures for these file formats. These content element names and types are defined in the following tables.

Table A.44 – Box element structure for a motion/video image

| Element name | Box name                             | Part 3   | Part 12  |
|--------------|--------------------------------------|----------|----------|
| jP_          | JPEG family signature box            | required |          |
| ftyp         | File type and compatibility box      | required | required |
| pdin         | Progressive download information box |          | optional |
| moov         | Movie box (superbox)                 | required | required |
| mvhd         | Movie header box                     | required | required |
| trak         | Track box (superbox)                 | required | required |
| tkhd         | Tack header box                      | required | required |
| tref         | Track reference container box        | optional | optional |
| edts         | Edit list container box (superbox)   | optional | optional |
| elst         | Edit list box                        | optional | optional |
| udta         | User-data box (superbox)             | optional | optional |
| cpri         | Copyright box                        | optional | optional |
| tsel         | Track selection box                  | optional | optional |
| mdia         | Media box (superbox)                 | required | required |
| mdhd         | Media header box                     | required | required |
| hdlr         | Handler box                          | required | required |
| minf         | Media information box (superbox)     | required | required |
| vmhd         | Video media header box               | optional | optional |
| smhd         | Sound media header box               | optional | optional |
| hmhd         | Hint media header box                | optional | optional |
| dinf         | Data information box (superbox)      | required | required |
| dref         | Data reference box                   | required | required |
| url_   urn_  | Data entry URL or Data entry URN     | optional | optional |

Table A.44 – Box element structure for a motion/video image

| Element name |      |      |             | Box name                                    | Part 3   | Part 12  |
|--------------|------|------|-------------|---------------------------------------------|----------|----------|
|              |      |      | url_        | Data entry URL                              | optional | optional |
|              |      |      | urn_        | Data entry URN                              | optional | optional |
|              |      |      | stbl        | Sample table box (superbox)                 | required | required |
|              |      |      | stsd        | Sample descriptions box                     | required | required |
|              |      |      | mjp2        | Video sample entry box                      | optional |          |
|              |      |      | jp2h        | JP2 header box (superbox)                   | required |          |
|              |      |      | fiel        | Field coding box                            | optional |          |
|              |      |      | jp2p        | Motion JPEG 2000 profile box                | optional |          |
|              |      |      | jp2x        | Motion JPEG 2000 prefix box                 | optional |          |
|              |      |      | jsub        | Motion JPEG 2000 sub-sampling box           | optional |          |
|              |      |      | orfo        | Motion JPEG 2000 original format box        | optional | optional |
|              |      |      | raw_        | Audio sample entry box                      | optional |          |
|              |      |      | twos        | Audio sample entry box                      | optional |          |
|              |      |      | stts        | Time-to-sample box (decoding)               | required | required |
|              |      |      | ctts        | Time-to-sample box (composition)            |          | optional |
|              |      |      | stsc        | Sample-to-chunk box                         | required | required |
|              |      |      | stsz        | Sample sizes box                            | required | optional |
|              |      |      | stz2        | Compact sample size box                     |          | optional |
|              |      |      | stco   co64 | Chunk offset box (32 bit or 64 bit)         | required | required |
|              |      |      | stss        | Sync sample table box                       |          | optional |
|              |      |      | stsh        | Shadow sync sample table box                |          | optional |
|              |      |      | padb        | Sample padding bits box                     |          | optional |
|              |      |      | stdp        | Sample degradation box                      |          | optional |
|              |      |      | sdtp        | Independent and disposable sample box       |          | optional |
|              |      |      | sbgp        | Sample-to-group box                         |          | optional |
|              |      |      | sgpd        | Sample group description box                |          | optional |
|              |      |      | subs        | Sub-sample information box                  |          | optional |
|              |      | meta |             | Metadata box                                |          | optional |
|              | meta |      |             | Metadata box                                |          | optional |
|              | udta |      |             | User-data box (superbox)                    | optional | optional |
|              | mvex |      |             | Movie extends box (superbox)                | optional | optional |
|              | mehd |      |             | Movie extends header box                    | optional | optional |
|              | trex |      |             | Track extends defaults box                  | required | required |
|              |      | ipmc |             | IPMP control box                            |          | optional |
| mdat         |      |      |             | Media data container box                    | optional | optional |
| moof         |      |      |             | Movie fragment box (superbox)               | optional | optional |
|              | mfhd |      |             | Movie fragment header box                   | required | required |
|              | traf |      |             | Track fragment box (superbox)               | optional | optional |
|              | tfhd |      |             | Track fragment header box                   | required | required |
|              | trun |      |             | Track fragment run box                      | optional | optional |
|              | sdtp |      |             | Independent and disposable sample box       |          | optional |
|              | sbgp |      |             | Sample-to-group box                         |          | optional |
|              | subs |      |             | Sub-sample information box                  |          | optional |
| mfra         |      |      |             | Movie fragment random access box (superbox) | optional | optional |
|              | tfra |      |             | Track fragment random access box            | optional | optional |
|              | mfro |      |             | Movie fragment rand. access offset box      | required | required |
| meta         |      |      |             | Metadata box                                |          | optional |
|              | hdlr |      |             | Handler box                                 |          | required |
|              | dinf |      |             | Data information box (superbox)             |          | optional |
|              | ipmc |      |             | IPMP control box                            |          | optional |

Table A.44 – Box element structure for a motion/video image

| Element name | Box name                                     | Part 3   | Part 12  |
|--------------|----------------------------------------------|----------|----------|
| iloc         | Item location box                            |          | optional |
| ipro         | Item protection box                          |          | optional |
| sinf         | Protection scheme information box (superbox) |          | optional |
| frma         | Original format box                          |          | optional |
| imif         | IPMP information box                         |          | optional |
| schm         | Scheme type box                              |          | optional |
| schl         | Scheme information box (superbox)            |          | optional |
| iinf         | Item information box                         |          | optional |
| _xml         | XML container box                            |          | optional |
| bxml         | Binary XML container box                     |          | optional |
| pitm         | Primary item reference box                   |          | optional |
| fiin         | File delivery item information box           |          | optional |
| paen         | Partition entry box (superbox)               |          | optional |
| fpar         | File pattern box                             |          | optional |
| fecr         | FEC reservoir box                            |          | optional |
| segr         | File delivery session group box              |          | optional |
| gitn         | Group id name box                            |          | optional |
| tsel         | Track selection box                          |          | optional |
| dinf         | Data information box (superbox)              |          | optional |
| meco         | Additional metadata container box (superbox) |          | optional |
| mere         | Metabox relation box                         |          | optional |
| meta         | Metadata box                                 |          | optional |
| skip free    | Free space box                               | optional | optional |

## A.2.2.1 Box element definitions for JPEG 2000 Part 3 format

Table A.45 – Content element name for mjp2

| content         | length   | type    | loop |
|-----------------|----------|---------|------|
| reserved        | 6        | integer |      |
| data_reference  | 2        | integer |      |
| predefined      | 2        | integer |      |
| reserved        | 2        | integer |      |
| predefined      | 12       | integer |      |
| width           | 2        | integer |      |
| height          | 2        | integer |      |
| hori_resolution | 4        | integer |      |
| vert_resolution | 4        | integer |      |
| reserved        | 4        | integer |      |
| predefined      | 2        | integer |      |
| name            | 32       | string  |      |
| depth           | 2        | integer |      |
| predefined      | 2        | integer |      |
| jp2h            | –        | box     |      |
| fiel            | optional | box     |      |
| jp2p            | optional | box     |      |
| jp2x            | optional | box     |      |
| jsub            | optional | box     |      |
| orfo            | optional | box     |      |

Table A.46 – Content element name for fiel

| content     | length | type    | loop |
|-------------|--------|---------|------|
| field_count | 1      | integer |      |
| field_order | 1      | integer |      |

Table A.47 – Content element name for jp2p

| content       | length | type    | loop |
|---------------|--------|---------|------|
| version       | 1      | integer |      |
| flag          | 3      | integer |      |
| compatibility | 4      | integer |      |

Table A.48 – Content element name for jp2x

| content    | length   | type    | loop |
|------------|----------|---------|------|
| codestream | variable | hexbyte |      |

Table A.49 – Content element name for fiel

| content     | length | type    | loop |
|-------------|--------|---------|------|
| field_count | 1      | integer |      |
| field_order | 1      | integer |      |

Table A.50 – Content element name for orfo

| content              | length | type    | loop |
|----------------------|--------|---------|------|
| original_field_count | 1      | integer |      |
| original_field_order | 1      | integer |      |

**Table A.51 – Content element name for jsub**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| hori_sub    | 1      | integer |      |
| vert_sub    | 1      | integer |      |
| hori_offset | 1      | integer |      |
| vert_offset | 1      | integer |      |

**Table A.52 – Content element name for raw\_ and twos**

| content        | length | type    | loop |
|----------------|--------|---------|------|
| reserved       | 6      | integer |      |
| data_reference | 2      | integer |      |
| reserved       | 8      | integer |      |
| channel_count  | 2      | integer |      |
| sample_size    | 2      | integer |      |
| predefined     | 2      | integer |      |
| reserved       | 2      | integer |      |
| sample_rate    | 4      | integer |      |

**A.2.2.2 Box element definitions for JPEG 2000 part 12 format****Table A.53 – Content element name for mdat**

| content | length   | type    | loop |
|---------|----------|---------|------|
| data    | variable | hexbyte |      |

**Table A.54 – Content element name for pdin**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| rate         | 4      | integer |      |
| inital_delay | 4      | integer | ]    |

**Table A.55 – Content element name for moov**

| content | length   | type | loop |
|---------|----------|------|------|
| mvhd    | —        | box  | =1   |
| trak    | —        | box  | ≥1   |
| mvex    | optional | box  | ≤1   |
| udta    | optional | box  | ≤1   |
| meta    | optional | box  | ≤1   |
| meco    | optional | box  | ≤1   |
| ipmc    | optional | box  | ≤1   |

**Table A.56 – Content element name for mvhd**

| content           | length | type    | loop |
|-------------------|--------|---------|------|
| version           | 1      | integer |      |
| flag              | 3      | integer |      |
| creation_time     | 4, 8   | integer |      |
| modification_time | 4, 8   | integer |      |
| time_scale        | 4      | integer |      |
| duration          | 4, 8   | integer |      |
| rate              | 4      | integer |      |
| volume            | 2      | integer |      |
| reserved          | 10     | integer |      |
| matrix            | 36     | hexbyte |      |
| predefined        | 24     | integer |      |
| next_track_id     | 4      | integer |      |

**Table A.57 – Content element name for free and skip**

| content | length   | type    | loop |
|---------|----------|---------|------|
| data    | variable | hexbyte |      |

**Table A.58 – Content element name for trak**

| content | length   | type | loop |
|---------|----------|------|------|
| tkhd    | —        | box  | =1   |
| mdia    | —        | box  | =1   |
| tref    | optional | box  | ≤1   |
| edts    | optional | box  | ≤1   |
| udta    | optional | box  | ≤1   |
| meta    | optional | box  | ≤1   |
| meco    | optional | box  | ≤1   |

**Table A.59 – Content element name for tkhd**

| content           | length | type    | loop |
|-------------------|--------|---------|------|
| version           | 1      | integer |      |
| flag              | 3      | integer |      |
| creation_time     | 4, 8   | integer |      |
| modification_time | 4, 8   | integer |      |
| track_id          | 4      | integer |      |
| reserved          | 4      | integer |      |
| duration          | 4, 8   | time    |      |
| reserved          | 8      | integer |      |
| layer             | 2      | integer |      |
| alternate_group   | 2      | integer |      |
| volume            | 2      | integer |      |
| reserved          | 2      | integer |      |
| matrix            | 36     | hexbyte |      |
| width             | 4      | integer |      |
| height            | 4      | integer |      |

**Table A.60 – Content element name for matrix**

| matrix | length | type    | loop |
|--------|--------|---------|------|
| cell   | 4      | integer |      |

**Table A.61 – Content element name for tref**

| content            | length | type    | loop |
|--------------------|--------|---------|------|
| hint   cdsc   hind | —      | hexbyte |      |

**Table A.62 – Content element name for hint, cdsc, and hind**

| hint   cdsc   hind | length | type    | loop |
|--------------------|--------|---------|------|
| track_id           | 4      | integer | ]    |

**Table A.63 – Content element name for mdia**

| content | length | type | loop |
|---------|--------|------|------|
| mdhd    | –      | box  | =1   |
| hdlr    | –      | box  | =1   |
| minf    | –      | box  | =1   |

**Table A.64 – Content element name for mdhd**

| content           | length | type    | loop |
|-------------------|--------|---------|------|
| version           | 1      | integer |      |
| flag              | 3      | integer |      |
| creation_time     | 4, 8   | integer |      |
| modification_time | 4, 8   | integer |      |
| time_scale        | 4      | integer |      |
| duration          | 4, 8   | integer |      |
| language          | 2      | integer |      |
| predefined        | 2      | integer |      |

**Table A.65 – Content element name for hdlr**

| content    | length   | type                                            | loop |
|------------|----------|-------------------------------------------------|------|
| version    | 1        | integer                                         |      |
| flag       | 3        | integer                                         |      |
| predefined | 4        | integer                                         |      |
| type       | 4        | integer<br>'vide'<br>'soun'<br>'hint'<br>'meta' |      |
| reserved   | 12       | integer                                         |      |
| name       | variable | string                                          |      |

**Table A.66 – Content element name for minf**

| content                   | length | type | loop |
|---------------------------|--------|------|------|
| vmhd   smhd   hmhd   nmhd | –      | box  | =1   |
| stbl                      | –      | box  | =1   |
| dinf                      | –      | box  | =1   |

**Table A.67 – Content element name for vmhd**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| graphic_mode | 2      | integer |      |
| op_code      | 2      | integer | 1    |

**Table A.68 – Content element name for hmhd**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| max_pdu_size | 2      | integer |      |
| avg_pdu_size | 2      | integer |      |
| max_bitrate  | 4      | integer |      |
| avg_bitrate  | 4      | integer |      |
| reserved     | 4      | integer |      |

**Table A.69 – Content element name for smhd**

| content  | length | type    | loop |
|----------|--------|---------|------|
| version  | 1      | integer |      |
| flag     | 3      | integer |      |
| balance  | 2      | integer |      |
| reserved | 2      | integer |      |

**Table A.70 – Content element name for stbl**

| content     | length   | type | loop |
|-------------|----------|------|------|
| stsd        | –        | box  | =1   |
| stdp        | optional | box  | ≤1   |
| stts        | –        | box  | =1   |
| ctts        | optional | box  | ≤1   |
| stss        | optional | box  | ≤1   |
| stsh        | optional | box  | ≤1   |
| sdtg        | optional | box  | ≤1   |
| stsz   stz2 | –        | box  | =1   |
| stsc        | –        | box  | =1   |
| stco   co64 | –        | box  | =1   |
| padb        | optional | box  | ≤1   |
| subs        | optional | box  | ≤1   |
| sbgp        | optional | box  | ≥0   |
| sgpd        | optional | box  | ≥0   |

**Table A.71 – Content element name for btrt**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| buffer_size | 4      | integer |      |
| max_bitrate | 4      | integer |      |
| avg_bitrate | 4      | integer |      |

**Table A.72 – Content element name for metx**

| content          | length   | type    | loop |
|------------------|----------|---------|------|
| reserved         | 6        | integer |      |
| data_reference   | 4        | integer |      |
| content_encoding | optional | string  |      |
| namespace        | variable | string  |      |
| location         | optional | string  |      |
| btrt             | optional | box     | ≥0   |

**Table A.73 – Content element name for mett**

| content          | length   | type    | loop |
|------------------|----------|---------|------|
| reserved         | 6        | integer |      |
| data_reference   | 4        | integer |      |
| content_encoding | optional | string  |      |
| mime_format      | variable | string  |      |
| btrt             | optional | box     | ≥0   |

**Table A.74 – Content element name for pasp**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| hori_spacing | 4      | integer |      |
| vert_spacing | 4      | integer |      |

**Table A.75 – Content element name for clap**

| content         | length | type    | loop |
|-----------------|--------|---------|------|
| width_num       | 4      | integer |      |
| width_den       | 4      | integer |      |
| height_num      | 4      | integer |      |
| height_den      | 4      | integer |      |
| hori_offset_num | 4      | integer |      |
| hori_offset_den | 4      | integer |      |
| vert_offset_num | 4      | integer |      |
| vert_offset_den | 4      | integer |      |

**Table A.76 – Content element name for Video coding**

| content         | length   | type    | loop |
|-----------------|----------|---------|------|
| reserved        | 6        | integer |      |
| data_reference  | 2        | integer |      |
| predefined      | 2        | integer |      |
| reserved        | 2        | integer |      |
| predefined      | 12       | integer |      |
| width           | 2        | integer |      |
| height          | 2        | integer |      |
| hori_resolution | 4        | integer |      |
| vert_resolution | 4        | integer |      |
| reserved        | 4        | integer |      |
| predefined      | 2        | integer |      |
| name            | 32       | string  |      |
| depth           | 2        | integer |      |
| predefined      | 2        | integer |      |
| clap            | optional | box     | ≤1   |
| pasp            | optional | box     | ≤1   |

**Table A.77 – Content element name for Audio coding**

| content        | length | type    | loop |
|----------------|--------|---------|------|
| reserved       | 6      | integer |      |
| data_reference | 2      | integer |      |
| reserved       | 8      | integer |      |
| channel_count  | 2      | integer |      |
| sample_size    | 2      | integer |      |
| predefined     | 2      | integer |      |
| reserved       | 2      | integer |      |
| sample_rate    | 4      | integer |      |

**Table A.78 – Content element name for stds**

| content            | length | type    | loop |
|--------------------|--------|---------|------|
| version            | 1      | integer |      |
| flag               | 3      | integer |      |
| num_entries        | 4      | integer |      |
| mjpeg   raw   twos | –      | box     | ]    |

**Table A.79 – Content element name for stdp**

| content  | length | type    | loop |
|----------|--------|---------|------|
| version  | 1      | integer |      |
| flag     | 3      | integer |      |
| priority | 2      | integer | ]    |

**Table A.80 – Content element name for stsl**

| content          | length | type    | loop |
|------------------|--------|---------|------|
| version          | 1      | integer |      |
| flag             | 3      | integer |      |
| constant_flag    | 1      | integer |      |
| scale_method     | 1      | integer |      |
| display_center_x | 2      | integer |      |
| display_center_y | 2      | integer |      |

**Table A.81 – Content element name for stts**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| num_entries  | 4      | integer |      |
| sample_count | 4      | integer | ]    |
| sample_delta | 4      | integer |      |

**Table A.82 – Content element name for ctts**

| content       | length | type    | loop |
|---------------|--------|---------|------|
| version       | 1      | integer |      |
| flag          | 3      | integer |      |
| num_entries   | 4      | integer |      |
| sample_count  | 4      | integer | ]    |
| sample_offset | 4      | integer |      |

**Table A.83 – Content element name for stss**

| content       | length | type    | loop |
|---------------|--------|---------|------|
| version       | 1      | integer |      |
| flag          | 3      | integer |      |
| num_entries   | 4      | integer |      |
| sample_number | 4      | box     | ]    |

**Table A.84 – Content element name for stsh**

| content                | length | type    | loop |
|------------------------|--------|---------|------|
| version                | 1      | integer |      |
| flag                   | 3      | integer |      |
| num_entries            | 4      | integer |      |
| shadowed_sample_number | 4      | integer | ]    |
| sync_sample_number     | 4      | integer |      |

**Table A.85 – Content element name for sdtp**

| content               | length | type    | loop |
|-----------------------|--------|---------|------|
| version               | 1      | integer |      |
| flag                  | 3      | integer |      |
| reserved              | 2      | integer | ]    |
| sample_depends_on     | 2      | integer |      |
| sample_is_depends_on  | 2      | integer |      |
| sample_has_redundancy | 2      | integer |      |

**Table A.86 – Content element name for edts**

| content | length   | type | loop |
|---------|----------|------|------|
| elst    | optional | box  | ≤1   |

Table A.87 – Content element name for elst

| content             | length | type    | loop |
|---------------------|--------|---------|------|
| version             | 1      | integer |      |
| flag                | 3      | integer |      |
| num_entries         | 4      | integer |      |
| segment_duration    | 4, 8   | integer | ]    |
| media_time          | 4, 8   | integer |      |
| media_rate_integer  | 2      | integer |      |
| media_rate_fraction | 2      | integer |      |

Table A.88 – Content element name for dinf

| content            | length | type | loop |
|--------------------|--------|------|------|
| dref   url_   urn_ | –      | box  | =1   |

Table A.89 – Content element name for url\_

| content  | length   | type    | loop |
|----------|----------|---------|------|
| version  | 1        | integer |      |
| flag     | 3        | integer |      |
| location | variable | string  |      |

Table A.90 – Content element name for urn\_

| content  | length   | type    | loop |
|----------|----------|---------|------|
| version  | 1        | integer |      |
| flag     | 3        | integer |      |
| name     | variable | string  |      |
| location | variable | string  |      |

Table A.91 – Content element name for dref

| content     | length | type    | loop |
|-------------|--------|---------|------|
| version     | 1      | integer |      |
| flag        | 3      | integer |      |
| num_entries | 4      | integer |      |
| url_   urn_ | –      | box     | ]    |

Table A.92 – Content element name for stsz

| content     | length | type    | loop |
|-------------|--------|---------|------|
| version     | 1      | integer |      |
| flag        | 3      | integer |      |
| sample_size | 4      | integer |      |
| num_entries | 4      | integer |      |
| entry_size  | 0, 4   | integer | ]    |

Table A.93 – Content element name for stz2

| content     | length     | type    | loop |
|-------------|------------|---------|------|
| version     | 1          | integer |      |
| flag        | 3          | integer |      |
| reserved    | 3          | integer |      |
| field_size  | 1          | integer |      |
| num_entries | 4          | integer |      |
| entry_size  | filed_size | integer | ]    |

Table A.94 – Content element name for stsc

| content           | length | type    | loop |
|-------------------|--------|---------|------|
| version           | 1      | integer |      |
| flag              | 3      | integer |      |
| num_entries       | 4      | integer |      |
| first_chunk       | 4      | integer | ]    |
| sample_per_chunk  | 4      | integer |      |
| description_index | 4      | integer |      |

Table A.95 – Content element name for stco

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| num_entries  | 4      | integer |      |
| chunk_offset | 4      | integer | ]    |

Table A.96 – Content element name for co64

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| num_entries  | 4      | integer |      |
| chunk_offset | 8      | integer | ]    |

Table A.97 – Content element name for padb

| content | length | type    | loop |
|---------|--------|---------|------|
| version | 1      | integer |      |
| flag    | 3      | integer |      |
| pad1    | 4      | integer | ]    |
| pad2    | 8      | integer |      |

Table A.98 – Content element name for subs

| content            | length | type    | loop |
|--------------------|--------|---------|------|
| version            | 1      | integer |      |
| flag               | 3      | integer |      |
| num_entries        | 4      | integer |      |
| sample_delta       | 4      | integer | ]    |
| num_subsample      | 2      | integer |      |
| subsample_size     | 4, 8   | integer |      |
| subsample_priority | 1      | integer |      |
| discardable        | 1      | integer |      |
| reserved           | 4      | integer |      |

Table A.99 – Content element name for mvex

| content | length   | type | loop |
|---------|----------|------|------|
| mehd    | optional | box  | ≤1   |
| trax    | –        | box  | =1   |

Table A.100 – Content element name for mehd

| content           | length | type    | loop |
|-------------------|--------|---------|------|
| version           | 1      | integer |      |
| flag              | 3      | integer |      |
| fragment_duration | 4, 8   | integer |      |

**Table A.101 – Content element name for trex**

| content                 | length | type    | loop |
|-------------------------|--------|---------|------|
| version                 | 1      | integer |      |
| flag                    | 3      | integer |      |
| track_id                | 4      | integer |      |
| default_sample_index    | 4      | integer |      |
| default_sample_duration | 4      | integer |      |
| default_sample_size     | 4      | integer |      |
| default_sample_flags    | 4      | integer |      |

**Table A.102 – Content element name for moof**

| content | length | type | loop |
|---------|--------|------|------|
| mfhd    | –      | box  |      |
| traf    | –      | box  |      |

**Table A.103 – Content element name for mfhd**

| content         | length | type    | loop |
|-----------------|--------|---------|------|
| version         | 1      | integer |      |
| flag            | 3      | integer |      |
| sequence_number | 4      | integer |      |

**Table A.104 – Content element name for traf**

| content | length   | type | loop |
|---------|----------|------|------|
| tfhd    | –        | box  | =1   |
| traf    | optional | box  | ≥0   |
| trun    | optional | box  | ≥0   |

**Table A.105 – Content element name for tfhd**

| content                  | length | type    | loop |
|--------------------------|--------|---------|------|
| version                  | 1      | integer |      |
| flag                     | 3      | integer |      |
| track_id                 | 4      | integer |      |
| base_data_offset         | 8      | integer |      |
| sample_description_index | 4      | integer |      |
| default_sample_duration  | 4      | integer |      |
| default_sample_size      | 4      | integer |      |
| default_sample_flags     | 4      | integer |      |

**Table A.106 – Content element name for trun**

| content            | length | type    | loop |
|--------------------|--------|---------|------|
| version            | 1      | integer |      |
| flag               | 3      | integer |      |
| num_entries        | 4      | integer |      |
| data_offset        | 4      | integer |      |
| first_sample_flags | 4      | integer |      |
| sample_duration    | 4      | integer | ]    |
| sample_size        | 4      | integer |      |
| sample_flags       | 4      | integer |      |
| sample_time_offset | 4      | integer |      |

**Table A.107 – Content element name for mfra**

| content | length | type | loop |
|---------|--------|------|------|
| tfra    | –      | box  |      |
| mfro    | –      | box  |      |

**Table A.108 – Content element name for tfra**

| content           | length              | type    | loop |
|-------------------|---------------------|---------|------|
| version           | 1                   | integer |      |
| flag              | 3                   | integer |      |
| track_id          | 4                   | integer |      |
| reserved          | 13/4                | integer |      |
| traf_index_size   | 1/4                 | integer |      |
| trun_index_size   | 1/4                 | integer |      |
| sample_index_size | 1/4                 | integer |      |
| num_entries       | 4                   | integer |      |
| time              | 4, 8                | integer | ]    |
| moof_offset       | 4, 8                | integer |      |
| traf_index        | traf_index_size+1   | integer |      |
| trun_index        | trun_index_size+1   | integer |      |
| sample_index      | sample_index_size+1 | integer |      |

**Table A.109 – Content element name for sbgp**

| content                 | length | type    | loop |
|-------------------------|--------|---------|------|
| version                 | 1      | integer |      |
| flag                    | 3      | integer |      |
| type                    | 4      | integer |      |
| num_entries             | 4      | integer |      |
| sample_count            | 4      | integer | ]    |
| group_description_index | 4      | integer |      |

**Table A.110 – Content element name for sgpd**

| content            | length   | type    | loop |
|--------------------|----------|---------|------|
| version            | 1        | integer |      |
| flag               | 3        | integer |      |
| type               | 4        | integer |      |
| default_length     | 0, 4     | integer |      |
| num_entries        | 4        | integer |      |
| description_length | 0, 4     | integer | ]    |
| data               | variable | hexbyte |      |

**Table A.111 – Content element name for udta**

| content | length   | type | loop |
|---------|----------|------|------|
| cpvt    | optional | box  | ≥0   |

**Table A.112 – Content element name for cpvt**

| content  | length   | type    | loop |
|----------|----------|---------|------|
| version  | 1        | integer |      |
| flag     | 3        | integer |      |
| language | 2        | integer |      |
| notice   | variable | string  |      |

Table A.113 – Content element name for tsel

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| switch_group | 4      | integer |      |
| attributes   | 4      | integer |      |

Table A.114 – Content element name for meta

| content    | length   | type    | loop |
|------------|----------|---------|------|
| version    | 1        | integer |      |
| flag       | 3        | integer |      |
| _xml_ bxml | optional | box     | ≤1   |
| iloc       | optional | box     | ≤1   |
| pitm       | optional | box     | ≤1   |
| ipro       | optional | box     | ≤1   |
| iinf       | optional | box     | ≤1   |
| ipmc       | optional | box     | ≤1   |
| fiim       | optional | box     | ≤1   |
| hdlr       | –        | box     | ≤1   |
| dinf       | –        | box     | ≤1   |

Table A.115 – Content element name for \_xml\_

| content | length   | type    | loop |
|---------|----------|---------|------|
| version | 1        | integer |      |
| flag    | 3        | integer |      |
| text    | variable | string  |      |

Table A.116 – Content element name for bxml

| content | length   | type    | loop |
|---------|----------|---------|------|
| version | 1        | integer |      |
| flag    | 3        | integer |      |
| data    | variable | hexbyte |      |

Table A.117 – Content element name for iloc

| content          | length           | type    | loop |
|------------------|------------------|---------|------|
| version          | 1                | integer |      |
| flag             | 3                | integer |      |
| offset_size      | 1/2              | integer |      |
| length_size      | 1/2              | integer |      |
| base_offset_size | 1/2              | integer |      |
| reserved         | 1/2              | integer |      |
| num_entries      | 2                | integer |      |
| item_id          | 2                | integer | ]    |
| data_reference   | 2                | integer |      |
| base_offset      | base_offset_size | integer |      |
| extent_count     | 2                | integer |      |
| extent_offset    | offset_size      | integer |      |
| extent_length    | length_size      | integer |      |
|                  |                  |         |      |

| content | length | type    | loop |
|---------|--------|---------|------|
| version | 1      | integer |      |
| flag    | 3      | integer |      |
| item_id | 2      | integer |      |

Table A.118 – Content element name for ipro

| content     | length | type    | loop |
|-------------|--------|---------|------|
| version     | 1      | integer |      |
| flag        | 3      | integer |      |
| num_entries | 2      | integer |      |
| sinf        | –      | box     | ]    |

Table A.119 – Content element name for infe

| content               | length   | type    | loop |
|-----------------------|----------|---------|------|
| version               | 1        | integer |      |
| flag                  | 3        | integer |      |
| item_id               | 2        | integer |      |
| item_protection_index | 2        | integer |      |
| item_name             | variable | string  |      |
| content_type          | variable | string  |      |
| content_encoding      | variable | string  |      |
| type                  | 0, 4     | integer |      |
| data                  | variable | box     | ]    |

Table A.120 – Content element name for iinf

| content     | length   | type    | loop |
|-------------|----------|---------|------|
| version     | 1        | integer |      |
| flag        | 3        | integer |      |
| num_entries | 2        | integer |      |
| infe        | variable | box     | ]    |

Table A.121 – Content element name for meco

| content | length   | type | loop |
|---------|----------|------|------|
| mere    | optional | box  | ≥0   |
| meta    | –        | box  | ≥1   |

Table A.122 – Content element name for mere

| content             | length | type    | loop |
|---------------------|--------|---------|------|
| version             | 1      | integer |      |
| flag                | 3      | integer |      |
| first_metabox_type  | 4      | integer |      |
| second_metabox_type | 4      | integer |      |
| metabox_relation    | 1      | integer |      |

Table A.123 – Content element name for sinf

| content | length   | type | loop |
|---------|----------|------|------|
| frma    | –        | box  | =1   |
| imif    | optional | box  | ≤1   |
| schm    | optional | box  | ≤1   |
| schi    | optional | box  | ≤1   |

Table A.124 – Content element name for frma

| content     | length | type    | loop |
|-------------|--------|---------|------|
| data_format | 4      | integer |      |

Table A.125 – Content element name for imif

| content          | length | type    | loop |
|------------------|--------|---------|------|
| version          | 1      | integer |      |
| flag             | 3      | integer |      |
| metabox_relation | 1      | hexbyte | 1    |

Table A.126 – Content element name for ipmc

| content          | length | type    | loop |
|------------------|--------|---------|------|
| version          | 1      | integer |      |
| flag             | 3      | integer |      |
| tool_list        | –      | hexbyte |      |
| num_entries      | 1      | integer |      |
| metabox_relation | –      | hexbyte | 1    |

Table A.127 – Content element name for schm

| content  | length   | type    | loop |
|----------|----------|---------|------|
| version  | 1        | integer |      |
| flag     | 3        | integer |      |
| type     | 4        | integer |      |
| version  | 4        | integer |      |
| location | variable | string  |      |

Table A.128 – Content element name for schi

| content          | length | type | loop |
|------------------|--------|------|------|
| Additional boxes | –      | box  | 1    |

Table A.129 – Content element name for paen

| content | length   | type | loop |
|---------|----------|------|------|
| fpar    | –        | box  | =1   |
| fecr    | optional | box  | ≤1   |

Table A.130 – Content element name for fin

| content     | length   | type    | loop |
|-------------|----------|---------|------|
| version     | 1        | integer |      |
| flag        | 3        | integer |      |
| num_entries | 2        | integer |      |
| paen        | –        | box     | 1    |
| segr        | optional | box     | ≤1   |
| gitn        | optional | box     | ≤1   |

Table A.131 – Content element name for fpar

| content                 | length   | type    | loop |
|-------------------------|----------|---------|------|
| version                 | 1        | integer |      |
| flag                    | 3        | integer |      |
| item_id                 | 2        | integer |      |
| packet_payload_size     | 2        | integer |      |
| reserved                | 1        | integer |      |
| FEC_encoding_id         | 1        | integer |      |
| FEC_instance_id         | 2        | integer |      |
| max_source_block_length | 2        | integer |      |
| symbol_length           | 2        | integer |      |
| max_num_symbols         | 2        | integer |      |
| scheme_specific_info    | variable | string  |      |
| num_entries             | 2        | integer |      |
| block_count             | 2        | integer | 1    |
| block_size              | 4        | integer |      |

Table A.132 – Content element name for fecr

| content      | length | type    | loop |
|--------------|--------|---------|------|
| version      | 1      | integer |      |
| flag         | 3      | integer |      |
| num_entries  | 2      | integer |      |
| item_id      | 2      | integer | 1    |
| symbol_count | 4      | integer |      |

Table A.133 – Content element name for segr

| content         | length | type    | loop |
|-----------------|--------|---------|------|
| num_entries     | 2      | integer |      |
| num_groups      | 1      | integer | 1    |
| group_id        | 4      | integer |      |
| num_hint_tracks | 2      | integer |      |
| hint_track_id   | 4      | integer |      |

Table A.134 – Content element name for gitn

| content     | length   | type    | loop |
|-------------|----------|---------|------|
| version     | 1        | integer |      |
| flag        | 3        | integer |      |
| num_entries | 2        | integer |      |
| group_id    | 4        | integer | 1    |
| group_name  | variable | string  |      |

Table A.135 – Content element name for rtp\_

| content            | length   | type    | loop |
|--------------------|----------|---------|------|
| reserved           | 6        | integer |      |
| data_reference     | 2        | integer |      |
| track_version      | 2        | integer |      |
| compatible_version | 2        | integer |      |
| max_packet_size    | 4        | integer |      |
| tims               | –        | box     | 1    |
| tsro               | optional | box     |      |
| snro               | optional | box     |      |

Table A.136 – Content element name for srtp

| content            | length   | type    | loop |
|--------------------|----------|---------|------|
| reserved           | 6        | integer |      |
| data_reference     | 2        | integer |      |
| track_version      | 2        | integer |      |
| compatible_version | 2        | integer |      |
| max_packet_size    | 4        | integer |      |
| tims               | –        | box     | 1    |
| srpp               | –        | box     |      |
| tsro               | optional | box     |      |
| snro               | optional | box     |      |

Table A.137 – Content element name for tims

| content    | length | type    | loop |
|------------|--------|---------|------|
| time_scale | 4      | integer |      |

Table A.138 – Content element name for tsro and snro

| content | length | type    | loop |
|---------|--------|---------|------|
| offset  | 4      | integer |      |

**Table A.139 – Content element name for srpp**

| content         | length | type    | loop |
|-----------------|--------|---------|------|
| version         | 1      | integer |      |
| flag            | 3      | integer |      |
| encryption_rtp  | 4      | integer |      |
| encryption_rtcp | 4      | integer |      |
| integrity_rtp   | 4      | integer |      |
| integrity_rtcp  | 4      | integer |      |
| schm            | –      | box     | =1   |
| schi            | –      | box     | ≤1   |

**Table A.140 – Content element name for rtpo**

| content | length | type    | loop |
|---------|--------|---------|------|
| offset  | 4      | integer |      |

**Table A.141 – Content element name for hnti**

| content | length | type | loop |
|---------|--------|------|------|
| hnti    | –      | box  | ≥0   |
| sdp_    | –      | box  | ≥0   |

**Table A.142 – Content element name for rtp\_**

| content | length   | type    | loop |
|---------|----------|---------|------|
| format  | 4        | integer |      |
| text    | variable | string  |      |

**Table A.143 – Content element name for sdp\_**

| content | length   | type   | loop |
|---------|----------|--------|------|
| text    | variable | string |      |

**Table A.144 – Content element name for hinf**

| content | length   | type | loop |
|---------|----------|------|------|
| trpy    | optional | box  | ≤1   |
| nump    | optional | box  | ≤1   |
| tpyl    | optional | box  | ≤1   |
| totl    | optional | box  | ≤1   |
| npck    | optional | box  | ≤1   |
| tpay    | optional | box  | ≤1   |
| maxr    | optional | box  | ≥0   |
| dmed    | optional | box  | ≤1   |
| dimm    | optional | box  | ≤1   |
| drep    | optional | box  | ≤1   |
| tmin    | optional | box  | ≤1   |
| tmax    | optional | box  | ≤1   |
| pmax    | optional | box  | ≤1   |
| dmax    | optional | box  | ≤1   |
| payt    | optional | box  | ≤1   |

**Table A.145 – Content element name for trpy, try1, dmed, dima and drep**

| content    | length | type    | loop |
|------------|--------|---------|------|
| bytes_sent | 8      | integer |      |

**Table A.146 – Content element name for totl and tpay**

| content    | length | type    | loop |
|------------|--------|---------|------|
| bytes_sent | 4      | integer |      |

**Table A.147 – Content element name for nump**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| packets_sent | 8      | integer |      |

**Table A.148 – Content element name for tmin, tmax and dmax**

| content | length | type    | loop |
|---------|--------|---------|------|
| time    | 4      | integer |      |

**Table A.149 – Content element name for npack**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| packets_sent | 4      | integer |      |

**Table A.150 – Content element name for pmax**

| content    | length | type    | loop |
|------------|--------|---------|------|
| bytes_sent | 4      | integer |      |

**Table A.151 – Content element name for maxr**

| content    | length | type    | loop |
|------------|--------|---------|------|
| period     | 4      | integer |      |
| bytes_sent | 4      | integer |      |

**Table A.152 – Content element name for hnti**

| content    | length | type    | loop |
|------------|--------|---------|------|
| payload_id | 4      | integer |      |
| count      | 1      | integer |      |
| rtpmap     | count  | integer |      |

**Table A.153 – Content element name for fdp\_**

| content            | length   | type    | loop |
|--------------------|----------|---------|------|
| reserved           | 6        | integer |      |
| data_reference     | 2        | integer |      |
| track_version      | 2        | integer |      |
| compatible_version | 2        | integer |      |
| partition_entry_id | 2        | integer |      |
| FEC_overhead       | 2        | integer |      |
| Additional boxes   | optional | box     | 1    |

**Table A.154 – Content element name for fdsa**

| content | length   | type | loop |
|---------|----------|------|------|
| fdpa    | variable | box  | ≥1   |
| extr    | variable | box  | ≤1   |

**Table A.155 – Content element name for fdpa**

| content        | length         | type    | loop |
|----------------|----------------|---------|------|
| header         | 3              | hexbyte |      |
| extension_size | 2              | integer |      |
| extension      | extension_size | hexbyte |      |
| packet_size    | 2              | integer |      |
| packet         | packet_size    | hexbyte |      |

Table A.156 – Content element name for extr

| content | length   | type    | loop |
|---------|----------|---------|------|
| data    | variable | hexbyte |      |

### A.2.3 Format definitions for multiple-page documents

The box file formats defined in Rec. ITU-T T.805 | ISO/IEC 15444-6 are designed to represent a multiple-page image such as a document image. These content element names and types are defined in the following tables.

Table A.157 – Box element structure for a document image

| Element name | Box name                            | Part 6   | Defined  |
|--------------|-------------------------------------|----------|----------|
| jp_          | JPEG family signature box           | required | 1        |
| ftyp         | File type and compatibility box     | required | 1        |
| jp2h         | JP2 header box (superbox)           | optional | 1, 2     |
| lbl_         | Label box                           | optional | 2, 6     |
| ihdr         | Image header box                    | optional | 1, 2, 6  |
| bpcc         | Bits per component box              | optional | 1        |
| colr         | Colour specification box            | optional | 1, 2, 6  |
| pclr         | Palette box                         | optional | 1        |
| cmap         | Component mapping box               | optional | 1        |
| cdef         | Channel description box             | optional | 1        |
| res_         | Resolution box (superbox)           | optional | 1        |
| resc         | Capture resolution box              | optional | 1        |
| resd         | Display resolution box              | optional | 1        |
| mhdr         | Compound image header box           | required | 6        |
| dtbl         | Data reference box                  | optional | 2, 6     |
| jp2c         | Contiguous codestream box           | optional | 1, 2, 6  |
| jp2i         | IPR box                             | optional | 1        |
| xml_         | XML container box                   | optional | 1, 2, 12 |
| uuid         | UUID box                            | optional | 1        |
| uinf         | UUID info box (superbox)            | optional | 1        |
| ulst         | UUID list box                       | optional | 1        |
| url_         | Data entry box                      | optional | 1        |
| pcol         | Page collection box                 | optional | 6        |
| ppcl         | Page collection locator box         | required | 6        |
| pagt         | Page table box                      | required | 6        |
| sdat         | Shared data entry box               | optional | 6        |
| sref         | Shared data reference box           | optional | 6        |
| page         | Page box (superbox) (1)             | required | 6        |
| phdr         | Page header box                     | required | 6        |
| ppcl         | Page collection locator box         | optional | 6        |
| sptr         | Spatial transformation box          | optional | 6        |
| phtx         | HTX Reference box                   | optional | 6        |
| htxb         | Hidden text metadata box (superbox) | optional | 6        |
| lobj         | Layout object box (superbox)        | optional | 6        |
| lhdr         | Layout object header box            | required | 6        |
| bclr         | Base colour box                     | optional | 6        |
| bcvl         | Base colour value box               | required | 6        |
| colr         | Colour specification box            | optional | 1, 2, 6  |
| bpcc         | Bits per component box              | optional | 1        |
| objc         | Object box (superbox)               | required | 6        |
| ohdr         | Object header box                   | required | 6        |
| scal         | Object scale box                    | optional | 6        |
| jp2h         | JP2 header box (superbox)           | optional | 1, 2, 6  |
| ftbl         | Fragment table box (superbox)       | optional | 2, 6     |
| flst         | Fragment list box                   | optional | 2, 6     |
| cref         | Cross-reference box (superbox)      | optional | 2, 6     |

Table A.157 – Box element structure for a document image

| Element name | Box name                               | Part 6   | Defined |
|--------------|----------------------------------------|----------|---------|
| flst         | Fragment list box                      | optional | 2, 6    |
| jp2c         | Contiguous codestream box for page (1) | optional | 1, 2, 6 |
| page         | Page box (superbox) (2)                | optional | 6       |
| jp2c         | Contiguous codestream box for page (2) | optional | 1, 2, 6 |
| htxb         | Hidden text metadata box (superbox)    | optional | 6       |

## A.2.3.1 Box element definitions for JPEG 2000 Part 6 format

Table A.158 – Content element name for mhdr

| content        | length | type    | loop |
|----------------|--------|---------|------|
| num_pages      | 4      | integer |      |
| profile        | 1      | integer |      |
| self_contained | 1      | integer |      |
| offset         | 8      | integer |      |
| length         | 4      | integer |      |
| mask_coder     | 1      | integer |      |
| image_coder    | 1      | integer |      |
| ipr            | 1      | integer |      |

Table A.159 – Content element name for pcol

| content | length   | type | loop |
|---------|----------|------|------|
| lbl_    | optional | box  | ≥0   |
| meta    | optional | box  | ≥0   |
| pagt    | –        | box  | =1   |

Table A.160 – Content element name for ppcl

| content        | length | type    | loop |
|----------------|--------|---------|------|
| offset         | 8      | integer |      |
| length         | 4      | integer |      |
| data_reference | 2      | integer |      |
| index          | 4      | integer |      |

Table A.161 – Content element name for pagt

| content        | length | type    | loop |
|----------------|--------|---------|------|
| num_entries    | 4      | integer | ]    |
| offset         | 8      | integer |      |
| length         | 4      | integer |      |
| data_reference | 2      | integer |      |
| flag           | 1      | hexbyte |      |

Table A.162 – Content element name for sdal

| content | length   | type    | loop |
|---------|----------|---------|------|
| id      | 2        | integer |      |
| data    | variable | hexbyte |      |

Table A.163 – Content element name for sref

| content | length | type    | loop |
|---------|--------|---------|------|
| id      | 2      | integer |      |

Table A.164 – Content element name for page

| content | length   | type | loop |
|---------|----------|------|------|
| phdr    | –        | box  | =1   |
| ppcl    | –        | box  | ≤1   |
| res_    | optional | box  | ≤1   |
| bclr    | optional | box  | ≤1   |
| meta    | optional | box  | ≥0   |
| lbl_    | optional | box  | ≥0   |
| lobj    | –        | box  | ≥1   |

Table A.165 – Content element name for phdr

| content     | length | type    | loop |
|-------------|--------|---------|------|
| num_lobjs   | 2      | integer |      |
| height      | 4      | integer |      |
| width       | 4      | integer |      |
| orientation | 2      | integer |      |
| colour      | 2      | integer |      |

Table A.166 – Content element name for lobj

| content | length   | type | loop |
|---------|----------|------|------|
| lhdr    | –        | box  | =1   |
| meta    | optional | box  | ≤1   |
| lbl_    | optional | box  | ≥0   |
| objc    | –        | box  | =1   |
| objc    | optional | box  | ≥1   |

Table A.167 – Content element name for lhdr

| content | length | type    | loop |
|---------|--------|---------|------|
| id      | 2      | integer |      |
| height  | 4      | integer |      |
| width   | 4      | integer |      |
| top     | 4      | integer |      |
| left    | 4      | integer |      |
| style   | 1      | integer |      |

Table A.168 – Content element name for objc

| content | length   | type | loop |
|---------|----------|------|------|
| ohdr    | –        | box  | =1   |
| bclr    | optional | box  | ≤1   |
| meta    | optional | box  | ≥0   |
| lab_    | optional | box  | ≥0   |
| scal    | optional | box  | ≤1   |
| jp2h    | optional | box  | ≤1   |

**Table A.169 – Content element name for ohdr**

| content        | length | type    | loop |
|----------------|--------|---------|------|
| type           | 1      | integer |      |
| no_codestream  | 1      | integer |      |
| top            | 4      | integer |      |
| left           | 4      | integer |      |
| offset         | 8      | integer |      |
| length         | 4      | integer |      |
| data_reference | 1      | integer |      |

**Table A.170 – Content element name for scal**

| content  | length | type    | loop |
|----------|--------|---------|------|
| vert_num | 2      | integer |      |
| vert_den | 2      | integer |      |
| hori_num | 2      | integer |      |
| hori_den | 2      | integer |      |

**Table A.171 – Content element name for bclr**

| content | length   | type | loop |
|---------|----------|------|------|
| bcvl    | –        | box  | =1   |
| colr    | –        | box  | =1   |
| bpcc    | optional | box  | ≤1   |

**Table A.172 – Content element name for bcvl**

| content        | length   | type    | loop |
|----------------|----------|---------|------|
| num_components | 2        | integer |      |
| depth          | 1        | integer |      |
| data           | variable | integer |      |

**Table A.173 – Content element name for htxb**

| content      | length   | type | loop |
|--------------|----------|------|------|
| lbl_         | optional | box  | ≤1   |
| _xml_   uuid | –        | box  | ≥1   |

**Table A.174 – Content element name for phtx**

| content | length   | type    | loop |
|---------|----------|---------|------|
| type    | 4        | integer |      |
| flst    | –        | box     | =1   |
| lbl_    | optional | box     | ≤1   |

#### A.2.4 Security format definitions

The box file formats defined in Rec. ITU-T T.807 | ISO/IEC 15444-8 are for a secure image file format. These content element names and types are defined in the following tables.

**Table A.175 – Box element structure for a motion/video image**

| Element name | Box name                                           | Part 8   | defined |
|--------------|----------------------------------------------------|----------|---------|
| moov         | Movie box (superbox)                               |          | 12      |
| trak         | Track box (superbox)                               |          | 12      |
| mdia         | Media box (superbox)                               |          | 12      |
| minf         | Media information box (superbox)                   |          | 12      |
| stbl         | Sample table box (superbox)                        | use      | 12      |
| stsd         | Sample descriptions box                            | use      | 12      |
| sces         | Scalable sample description entry box              | optional | 8       |
| dcsc         | Scalable sample description entry box              | optional | 8       |
| encv         | Scalable sample description entry box (enc video)  | optional | 8       |
| autv         | Scalable sample description entry box (auth video) | optional | 8       |
| enct         | Scalable sample description entry box (enc text)   | optional | 8       |
| autt         | Scalable sample description entry box (auth text)  | optional | 8       |
| encs         | Scalable sample description entry box (enc sys)    | optional | 8       |
| auts         | Scalable sample description entry box (auth sys)   | optional | 8       |
| sbgp         | Sample-to-group box                                | use      | 12      |
| sgpd         | Sample group description box                       | use      | 12      |
| attr         | Scalable sample group entry box (media char)       | optional | 8       |
| prot         | Scalable sample group entry box (protection)       | optional | 8       |
| subs         | Sub-sample information box                         |          | 12      |
| meta         | Metadata box                                       | use      | 12      |
| meta         | Metadata box                                       | use      | 12      |
| meta         | Metadata box                                       | use      | 12      |
| iloc         | Item location box                                  | use      | 12      |
| ipro         | Item protection box                                | use      | 12      |

Table A.175 – Box element structure for a motion/video image

| Element name |      |      |      | Box name                                     | Part 8   | defined |
|--------------|------|------|------|----------------------------------------------|----------|---------|
|              |      | sinf |      | Protection scheme information box (superbox) | use      | 12      |
|              |      | frma |      | Original format box                          | use      | 12      |
|              |      | schm |      | Scheme type box                              | use      | 12      |
|              |      | schi |      | Scheme information box (superbox)            | use      | 12      |
|              |      | gran |      | Granularity box                              | optional | 8       |
|              |      | vall |      | Value list box                               | optional | 8       |
|              |      | bcip |      | Block cipher box                             | optional | 8       |
|              |      |      | keyt | Key template box                             | optional | 8       |
|              |      | scip |      | Stream cipher box                            | optional | 8       |
|              |      |      | keyt | Key template box                             | optional | 8       |
|              |      | auth |      | Authentication box                           | optional | 8       |
|              |      |      | keyt | Key template box                             | optional | 8       |
|              | iinf |      |      | Item information box                         | use      | 12      |
|              | ides |      |      | Item description box                         | optional | 8       |
|              |      | dest |      | Description type box                         | optional | 8       |
|              |      | desd |      | Description data box                         | optional | 8       |
|              |      | vide |      | Visual item description entry box            | optional | 8       |
|              |      | j2ke |      | JPEG 2000 item description entry box         | optional | 8       |
|              | icor |      |      | Item correspondence box                      | optional | 8       |
|              | meta |      |      | Metadata box                                 | use      | 12      |
| gprrt        |      |      |      | Generic protected box                        | optional | 8       |

## A.2.4.1 Box element definitions for JPEG 2000 Part 8 format

Table A.176 – Content element name for gprrt

| content       |                  | length         | type    | loop |
|---------------|------------------|----------------|---------|------|
| type_flag     |                  | 1/8            | integer |      |
| size_flag     |                  | 1/8            | integer |      |
| location_flag |                  | 1/8            | integer |      |
| reserved      |                  | 5/8            | integer |      |
| if flags ≠ 0  | num_entries      | 0, 4           | integer | ]    |
|               | offset_size      | 0, 4           | integer |      |
|               | box_length       | 0, 4           | integer |      |
|               | box_type         | 0, 4           | integer |      |
|               | box_ext_length   | 0, 8           | integer |      |
|               | offset           | 0, offset_size | integer |      |
| else          | total_length     | 0, 4           | integer |      |
|               | total_ext_length | 0, 8           | integer |      |

Table A.177 – Content element name for sces and decs

| content         | length   | type    | loop |
|-----------------|----------|---------|------|
| reserved        | 6        | integer |      |
| data_reference  | 2        | integer |      |
| predefined      | 2        | integer |      |
| reserved        | 2        | integer |      |
| predefined      | 12       | integer |      |
| width           | 2        | integer |      |
| height          | 2        | integer |      |
| hori_resolution | 4        | integer |      |
| vert_resolution | 4        | integer |      |
| reserved        | 4        | integer |      |
| predefined      | 2        | integer |      |
| name            | 32       | string  |      |
| depth           | 2        | integer |      |
| predefined      | 2        | integer |      |
| clap            | optional | box     | ≤1   |
| pasp            | optional | box     | ≤1   |
| res             | 1        | integer |      |
| layer           | 1        | integer |      |
| cropped_width   | 4        | integer |      |
| cropped_height  | 4        | integer |      |
| startx          | 0, 4     | integer |      |
| starty          | 0, 4     | integer |      |

**Table A.178 – Content element name for gran**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| granularity | 1      | integer |      |

**Table A.179 – Content element name for vall**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| size        | 1      | integer |      |
| num_entries | 2      | integer |      |
| count       | 2      | integer | ⌋    |
| value       | size   | integer | ⌋    |

**Table A.180 – Content element name for keyt**

| content  | length   | type    | loop |
|----------|----------|---------|------|
| size     | 2        | integer |      |
| key_info | 1        | integer |      |
| gran     | optional | box     | ≤1   |
| vall     | –        | box     | =1   |

**Table A.181 – Content element name for bcip**

| content      | length | type    | loop |
|--------------|--------|---------|------|
| cipher_id    | 2      | integer |      |
| cipher_mode  | 6/8    | integer |      |
| padding_mode | 2/8    | integer |      |
| size         | 1      | integer |      |
| keyt         | –      | box     | =1   |

**Table A.182 – Content element name for scip**

| content   | length | type    | loop |
|-----------|--------|---------|------|
| type      | 1      | integer |      |
| cipher_id | 2      | integer |      |
| keyt      | –      | box     | =1   |

**Table A.183 – Content element name for schi**

| content       | length | type    | loop |
|---------------|--------|---------|------|
| type          | 1      | integer |      |
| box_protected | 1      | integer |      |
| bcip   scip   | –      | box     | =1   |
| gran          | –      | box     | =1   |
| vall          | –      | box     | =1   |

**Table A.184 – Content element name for auth**

| content   | length | type    | loop |
|-----------|--------|---------|------|
| type      | 1      | integer |      |
| method_id | 1      | integer |      |
| hash_id   | 1      | integer |      |
| size      | 2      | integer |      |
| keyt      | –      | box     | =1   |

**Table A.185 – Content element name for schi**

| content | length   | type    | loop |
|---------|----------|---------|------|
| type    | 1        | integer |      |
| auth    | –        | box     | =1   |
| gran    | optional | box     | ≤1   |
| vall    | –        | box     | =1   |

**Table A.186 – Content element name for ides**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| num_entries | 4      | integer |      |
| dest        | –      | box     | ⌋    |
| item_id     | 4      | integer |      |
| desd        | –      | box     |      |

**Table A.187 – Content element name for vide**

| content     | length | type    | loop |
|-------------|--------|---------|------|
| layer_start | 2      | integer |      |
| layer_count | 2      | integer |      |
| res_start   | 2      | integer |      |
| res_count   | 2      | integer |      |
| hori_offset | 2      | integer |      |
| hori_length | 2      | integer |      |
| vert_offset | 2      | integer |      |
| vert_length | 2      | integer |      |
| colour      | 2      | integer |      |
| time_start  | 2      | integer |      |
| time_length | 2      | integer |      |

**Table A.188 – Content element name for j2ke**

| content          | length   | type    | loop |
|------------------|----------|---------|------|
| vide             | optional | box     |      |
| tile_start       | 2        | integer |      |
| tile_count       | 2        | integer |      |
| precinct_start   | 2        | integer |      |
| precinct_count   | 2        | integer |      |
| j2k_packet_start | 2        | integer |      |
| j2k_packet_count | 2        | integer |      |

**Table A.189 – Content element name for dest**

| content  | length | type    | loop |
|----------|--------|---------|------|
| type     | 4      | integer |      |
| version  | 4      | integer |      |
| location | –      | string  |      |

**Table A.190 – Content element name for desd**

| content        | length | type | loop |
|----------------|--------|------|------|
| Additional box | –      | box  | ⌋    |

**Table A.191 – Content element name for icor**

| content | length | type    | loop |
|---------|--------|---------|------|
| item_id | 2      | integer |      |
| desc_id | 2      | integer |      |

**Table A.192 – Content element name for port and attr**

| content        | length | type    | loop |
|----------------|--------|---------|------|
| resolution     | 1      | integer |      |
| layer          | 1      | integer |      |
| cropped_width  | 4      | integer |      |
| cropped_height | 4      | integer |      |
| startx         | 0, 4   | integer |      |
| starty         | 0, 4   | integer |      |

### A.3 Examples of XML schemas

The following examples are XML schemas for box types of JPEG 2000 family format.

#### A.3.1 Example of an XML schema for a common header

The following example is of common XML schemas for all box types of JPEG 2000 family format.

```
<?xml version="1.0" ?>
<xs:schema xmlns:xs="http://www.iso.org/jpeg/2001/XMLSchema"
  targetNamespace="http://www.iso.org/jpxml"
  xmlns="http://www.iso.org/jpxml">
  <xs:attributeGroup name="attrs.box">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="offset" type="xs:integer" use="optional" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="box" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.4cc">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="fourcc" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.hex">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="hexbyte" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.int">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="integer" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.str">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="string" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.url">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="location" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>
  <xs:attributeGroup name="attrs.root">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="name" type="xs:anyURL" use="optional" />
  </xs:attributeGroup>
  <!-- add following XML Schemas for the JPXML document. -->
  ...
</xs:schema>
```

## A.3.2 Example of an XML schema for a JPEG 2000 Part 1 image (single image)

```

<!-- jpxml part 1 root element -->
<xs:element name="jpxml">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.root" />
    <xs:sequence>
      <xs:element ref="jp" />
      <xs:element ref="ftyp" />
      <xs:element ref="jp2h" />
      <xs:element ref="jp2i" minOccurs="0" />
      <xs:element ref="xml" minOccurs="0" />
      <xs:element ref="uuid" minOccurs="0" />
      <xs:element ref="uinf" minOccurs="0" />
      <xs:element ref="jp2c" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 box element -->
<xs:element name="jp__">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="signature" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ftyp">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="brand" />
      <xs:element ref="version" />
      <xs:element ref="compatibility"
        minOccurs="0" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jp2h">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="ihdr" />
      <xs:element ref="bpcc" minOccurs="0" />
      <xs:element ref="colr" />
      <xs:element ref="pclr" minOccurs="0" />
      <xs:element ref="cmap" minOccurs="0" />
      <xs:element ref="cdef" minOccurs="0" />
      <xs:element ref="res_" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ihdr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="height">
        <xs:attributeGroup ref="attrs.int"
          use="required" />
      </xs:element>
      <xs:element ref="width" />
      <xs:element ref="num_components" />
      <xs:element ref="depth" />
      <xs:element ref="compression" />
      <xs:element ref="colour_unknown" />
      <xs:element ref="ipr" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="colr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="method" />
      <xs:element ref="precedence" />
      <xs:element ref="approx" />
      <xs:element ref="colour" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="bpcc">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="depth"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="pclr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_entries" />
      <xs:element ref="num_components" />
      <xs:element ref="depth"
        maxOccurs="unbounded" />
      <xs:element ref="data"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="cdef">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="index" />
        <xs:element ref="type" />
        <xs:element ref="assoc" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="res_">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="resc" minOccurs="0" />
      <xs:element ref="resd" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="resd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="vert_num" />
      <xs:element ref="vert_den" />
      <xs:element ref="hori_num" />
      <xs:element ref="hori_den" />
      <xs:element ref="vert_exp" />
      <xs:element ref="hori_exp" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="resd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="vert_num" />
      <xs:element ref="vert_den" />
      <xs:element ref="hori_num" />
      <xs:element ref="hori_den" />
      <xs:element ref="vert_exp" />
      <xs:element ref="hori_exp" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

</xs:element>

<xs:element name="uuid">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="id" />
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="uinf">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="ulst" />
      <xs:element ref="url_" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ulst">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num entries" />
      <xs:element ref="uuid" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="url_">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="location" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="xml">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="text" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jp2c">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 content element -->

<xs:element name="signature" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

<xs:element name="brand" type="fourcc">
  <xs:attributeGroup ref="attrs.4cc"
    use="required" />
</xs:element>

<xs:element name="version" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="compatibility" type="fourcc">
  <xs:attributeGroup ref="attrs.4cc"
    use="required" />
</xs:element>

```

```

<xs:element name="width" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="num components"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="depth" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="compression"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="colour unknown"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="ipr" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="method" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="precedence" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="approx" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="colour" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

<xs:element name="num_entries"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="depth" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="data" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

<xs:element name="index" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="type" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="assoc" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

<xs:element name="vert_num" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

```

<xs:element name="vert den" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="hori_num" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="hori_den" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="vert_exp" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

```

<xs:element name="hori_exp" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="location" type="location">
  <xs:attributeGroup ref="attrs.url"
    use="required" />
</xs:element>

<xs:element name="text" type="xs:string">
  <xs:attributeGroup ref="attrs.str"
    use="required" />
</xs:element>

```

### A.3.3 Example of an XML schema for a JPEG 2000 Part 2 image (single/layered image)

```

<!-- jpxml part 2 root element -->
<xs:element name="jpxml">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.root" />
    <xs:sequence>
      <xs:element ref="jp" />
      <xs:element ref="ftyp" />
      <xs:element ref="rreq" />
      <xs:element ref="jp2h" />
      <xs:element ref="jpch" minOccurs="0" />
      <xs:element ref="jplh" minOccurs="0" />
      <xs:element ref="dtbl" minOccurs="0" />
      <xs:element ref="ftbl" minOccurs="0" />
      <xs:element ref="jp2i" minOccurs="0" />
      <xs:element ref="jp2c" minOccurs="0" />
      <xs:element ref="mdat" minOccurs="0" />
      <xs:element ref="comp" minOccurs="0" />
      <xs:element ref="drep" minOccurs="0" />
      <xs:element ref="roid" minOccurs="0" />
      <xs:element ref="cref" minOccurs="0" />
      <xs:element ref="asoc" minOccurs="0" />
      <xs:element ref="bfil" minOccurs="0" />
      <xs:element ref="chck" minOccurs="0" />
      <xs:element ref="mp7b" minOccurs="0" />
      <xs:element ref="free" minOccurs="0" />
      <xs:element ref="xml" minOccurs="0" />
      <xs:element ref="uuid" minOccurs="0" />
      <xs:element ref="uinf" minOccurs="0" />
      <xs:element ref="jclx" minOccurs="0" />
      <xs:element ref="j2cx" minOccurs="0" />
      <xs:element ref="grp" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 box element -->
...
<!-- part 2 box element -->
<xs:element name="rreq">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="length" />
      <xs:element ref="fua mask" />
      <xs:element ref="dc mask" />
      <xs:element ref="num std flags" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="std_flag" />
        <xs:element ref="std mask" />
      </xs:sequence>
      <xs:element ref="num vnder features" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="vnder_feature" />
        <xs:element ref="vnder mask" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="dtbl">

```

```

<xs:complexType>
  <xs:attributeGroup ref="attrs.box"
    use="required" />
  <xs:sequence>
    <xs:element ref="num_entries" />
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="location" />
    </xs:sequence>
  </xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="ftbl">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="flst" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="flst">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="offset" />
        <xs:element ref="length" />
        <xs:element ref="data_reference" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="cref">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="flst" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jpch">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="lbl_" minOccurs="0" />
      <xs:element ref="ihdr" />
      <xs:element ref="bpcc" minOccurs="0" />
      <xs:element ref="pclr" minOccurs="0" />
      <xs:element ref="cmap" minOccurs="0" />
      <xs:element ref="roid" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

<xs:element name="jplh">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="lbl" minOccurs="0" />
      <xs:element ref="cgrp" minOccurs="0" />
      <xs:element ref="opct" minOccurs="0" />
      <xs:element ref="cdef" minOccurs="0" />
      <xs:element ref="creq" minOccurs="0" />
      <xs:element ref="res" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="colour">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
    <xs:choice>
      <xs:sequence>
        <xs:element ref="enum_colour" />
        <xs:element ref="enum_param" />
      </xs:sequence>
      <xs:sequence>
        <xs:element ref="vender_colour" />
        <xs:element ref="vendar_param" />
      </xs:sequence>
    </xs:choice>
  </xs:complexType>
</xs:element>

<xs:element name="enum_param">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
    <xs:choice>
      <xs:sequence>
        <xs:element ref="range_L" />
        <xs:element ref="offset_L" />
        <xs:element ref="range_a" />
        <xs:element ref="offset_a" />
        <xs:element ref="range_b" />
        <xs:element ref="offset_b" />
        <xs:element ref="illuminant" />
      </xs:sequence>
      <xs:sequence>
        <xs:element ref="range_J" />
        <xs:element ref="offset_J" />
        <xs:element ref="range_a" />
        <xs:element ref="offset_a" />
        <xs:element ref="range_b" />
        <xs:element ref="offset_b" />
      </xs:sequence>
    </xs:choice>
  </xs:complexType>
</xs:element>

<xs:element name="cgrp">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="colr" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="opct">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="num_entries" />
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="creq">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="hori_size" />
      <xs:element ref="vert_size" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```

    <xs:element ref="cds_num" />
    <xs:element ref="hori_resolution" />
    <xs:element ref="vert_resolution" />
    <xs:element ref="hori_offset" />
    <xs:element ref="vert_offset" />
    <xs:element ref="num_entries" />
  </xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="free">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="comp">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="copt" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="inst" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="copt">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="height" />
      <xs:element ref="width" />
      <xs:element ref="loop" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="inst">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="repetition" />
      <xs:element ref="duration" />
      <xs:element ref="instruction" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="instruction" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
  <xs:sequence>
    <xs:element ref="hori_offset" />
    <xs:element ref="vert_offset" />
    <xs:element ref="width" />
    <xs:element ref="height" />
    <xs:element ref="life" />
    <xs:element ref="next_use" />
    <xs:element ref="vert_crop_offset" />
    <xs:element ref="hori_crop_offset" />
    <xs:element ref="crop_width" />
    <xs:element ref="crop_height" />
  </xs:sequence>
</xs:element>

<xs:element name="nlst">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="asoc_num" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="lbl">
  <xs:complexType>

```

```

<xs:attributeGroup ref="attrs.box"
    use="required" />
<xs:sequence>
  <xs:element ref="label" />
</xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="bfil">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
        use="required" />

    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="drep">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
        use="required" />

    <xs:sequence>
      <xs:element ref="gtso" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="gtso">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
        use="required" />

    <xs:sequence>
      <xs:element ref="profile" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="roid">
  <xs:attributeGroup ref="attrs.box"
    use="required" />

  <xs:sequence>
    <xs:element ref="num_entries" />
    <xs:element ref="contained" />
    <xs:element ref="type" />
    <xs:element ref="priority" />
    <xs:element ref="left" />
    <xs:element ref="top" />
    <xs:element ref="width" />
    <xs:element ref="height" />
  </xs:sequence>
</xs:element>

<xs:element name="chck">
  <xs:attributeGroup ref="attrs.box"
    use="required" />

  <xs:sequence>

```

```

<xs:element ref="signature type" />
<xs:element ref="source type" />
<xs:element ref="offset" />
<xs:element ref="length" />
<xs:element ref="data" />
</xs:sequence>
</xs:element>

<xs:element name="mp7b">
  <xs:attributeGroup ref="attrs.box"
    use="required" />

  <xs:sequence>
    <xs:element ref="data" />
  </xs:sequence>
</xs:element>

<!-- part 1 content element -->
...
<!-- part 3 content element -->
<xs:element name="length"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="offset" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="data reference"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="enum_colour"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="enum param" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

<xs:element name="vender colour"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="vendar_param" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>

```

#### A.3.4 Example of an XML schema for a JPEG 2000 Part 3 image (motion image)

```

<!-- jpxml part 3 root element -->
<xs:element name="jpxml">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.root" />
    <xs:sequence>
      <xs:element ref="jp" />
      <xs:element ref="ftyp" />
      <xs:element ref="pdin" minOccurs="0" />
      <xs:element ref="moov" />
      <xs:element ref="mdat" minOccurs="0" />
      <xs:element ref="moof" minOccurs="0" />
      <xs:element ref="mfra" minOccurs="0" />
      <xs:element ref="meta" minOccurs="0" />
      <xs:element ref="meco" minOccurs="0" />
      <xs:element ref="skip" minOccurs="0" />
      <xs:element ref="free" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 box element -->
<!-- part 12 box element -->
...
<!-- part 3 box element -->

```

```

<xs:element name="mip2">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
        use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data_reference" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="width" />
      <xs:element ref="height" />
      <xs:element ref="hori resolution" />
      <xs:element ref="vert resolution" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="name" />
      <xs:element ref="depth" />
      <xs:element ref="predefined" />
      <xs:element ref="length" />
      <xs:element ref="jp2h" />
      <xs:element ref="fiel" minOccurs="0" />
      <xs:element ref="jp2p" minOccurs="0" />
      <xs:element ref="jp2x" minOccurs="0" />
      <xs:element ref="jsub" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>

```

```

    <xs:element ref="orfo" minOccurs="0" />
  </xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="fiel">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="field count" />
      <xs:element ref="field_order" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="orfo">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="original field count" />
      <xs:element ref="original field order" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jp2p">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="compatibility" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jp2x">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="jsub">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="hori_sub" />
      <xs:element ref="vert_sub" />
      <xs:element ref="hori_offset" />
      <xs:element ref="vert_offset" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="raw">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data_reference" />
      <xs:element ref="reserved" />
      <xs:element ref="channel_count" />
      <xs:element ref="sample_size" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="sample_rate" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 3 content element -->
<xs:element name="reserved" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

```

<xs:element name="predefined"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="hori_resolution"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="vert_resolution"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="name" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="field_count"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="field_order"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="original_field_count"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="original_field_order"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="version" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="flag" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="hori_sub" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="vert_sub" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="channel_count"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="sample_size"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="sample_rate"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

## A.3.5 Example of an XML schema for a JPEG 2000 Part 6 image (document image)

```

<!-- jpxml part 6 root element -->
<xs:element name="jpxml">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.root" />
    <xs:sequence>
      <xs:element ref="jp__" />
      <xs:element ref="ftyp" />
      <xs:element ref="jp2h" minOccurs="0" />
      <xs:element ref="mhdr" />
      <xs:element ref="pcol" minOccurs="0" />
      <xs:element ref="page" />
      <xs:element ref="sdat" minOccurs="0" />
      <xs:element ref="dtbl" minOccurs="0" />
      <xs:element ref="ftbl" minOccurs="0" />
      <xs:element ref="cref" minOccurs="0" />
      <xs:element ref="jp2i" minOccurs="0" />
      <xs:element ref="jp2c" minOccurs="0" />
      <xs:element ref="xml" minOccurs="0" />
      <xs:element ref="uuid" minOccurs="0" />
      <xs:element ref="uinf" minOccurs="0" />
      <xs:element ref="free" minOccurs="0" />
      <xs:element ref="htxb" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 box element -->
<!-- part 2 box element -->
...
<!-- part 6 box element -->
<xs:element name="mhdr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num pages" />
      <xs:element ref="profile" />
      <xs:element ref="self_contained" />
      <xs:element ref="offset" />
      <xs:element ref="length" />
      <xs:element ref="mask coder" />
      <xs:element ref="image coder" />
      <xs:element ref="ipr" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="pcol">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="lbl_"
        minOccurs="0" />
      <xs:element ref="meta"
        minOccurs="0" />
      <xs:element ref="pagt" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ppcl">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="offset" />
      <xs:element ref="length" />
      <xs:element ref="data reference" />
      <xs:element ref="index" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="pagt">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="offset" />
        <xs:element ref="length" />
        <xs:element ref="data reference" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="sref">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="id" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="page">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="phdr" />
      <xs:element ref="ppcl"
        minOccurs="0" />
      <xs:element ref="res"
        minOccurs="0" />
      <xs:element ref="bclr"
        minOccurs="0" />
      <xs:element ref="meta"
        minOccurs="0" />
      <xs:element ref="lbl_"
        minOccurs="0" />
      <xs:element ref="lobj"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="phdr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num lobjs" />
      <xs:element ref="height" />
      <xs:element ref="width" />
      <xs:element ref="orientation" />
      <xs:element ref="colour" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="lobj">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="ihdr" />
      <xs:element ref="meta"
        minOccurs="0" />
      <xs:element ref="lbl_"
        minOccurs="0" />
      <xs:element ref="objc"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="lhdr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"

```

```

        use="required" />
      <xs:sequence>
        <xs:element ref="id" />
        <xs:element ref="height" />
        <xs:element ref="width" />
        <xs:element ref="top" />
        <xs:element ref="left" />
        <xs:element ref="style" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="objc">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="ohdr" />
        <xs:element ref="bclr"
          minOccurs="0" />
        <xs:element ref="meta"
          minOccurs="0" />
        <xs:element ref="lbl"
          minOccurs="0" />
        <xs:element ref="scal"
          minOccurs="0" />
        <xs:element ref="jp2h"
          minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="lhdr">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="type" />
        <xs:element ref="no_codestream" />
        <xs:element ref="top" />
        <xs:element ref="left" />
        <xs:element ref="offset" />
        <xs:element ref="length" />
        <xs:element ref="data_reference" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="scal">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="vert_num" />
        <xs:element ref="vert_den" />
        <xs:element ref="hori_num" />
        <xs:element ref="hori_den" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="bclr">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="bcvl" />
        <xs:element ref="colr"
          minOccurs="0" />
        <xs:element ref="bpcc"
          minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="bcvl">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="num_components" />
        <xs:element ref="depth" />
        <xs:element ref="data" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

  <xs:element name="htxb">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="lbl"
          minOccurs="0" />
        <xs:sequence maxOccurs="unbounded">
          <xs:choice>
            <xs:element ref="_xml" />
            <xs:element ref="uuid" />
          </xs:choice>
        </xs:sequence>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="phtx">
    <xs:complexType>
      <xs:attributeGroup ref="attrs.box"
        use="required" />

      <xs:sequence>
        <xs:element ref="type" />
        <xs:element ref="flst" />
        <xs:element ref="lbl"
          minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <!-- part 1 content element -->
  <!-- part 2 content element -->
  ...
  <!-- part 6 content element -->
  <xs:element name="profile" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="self contained"
    type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="offset" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="mask coder" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="image coder" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="flag" type="hexbyte">
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
  </xs:element>

  <xs:element name="num_lobjs"
    type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="orientation"
    type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="top" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

  <xs:element name="left" type="xs:integer">
    <xs:attributeGroup ref="attrs.int"
      use="required" />
  </xs:element>

```

```
<xs:element name="style" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>
```

```
<xs:element name="no codestream"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>
```

### A.3.6 Example of an XML schema for a JPEG 2000 Part 8 image (security)

```
<!-- part 1 box element -->
<!-- part 8 box element -->
<xs:element name="gpvt">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type_flag" />
      <xs:element ref="size_flag" />
      <xs:element ref="location_flag" />
      <xs:element ref="reserved" />
      <xs:choice>
        <xs:sequence>
          <xs:element ref="num_entries" />
          <xs:sequence maxOccurs="unbounded">
            <xs:element ref="offset_size" />
            <xs:element ref="box_length" />
            <xs:element ref="box_type" />
            <xs:element ref="box_ext_length" />
            <xs:element ref="offset" />
          </xs:sequence>
        </xs:sequence>
        <xs:sequence>
          <xs:element ref="total_length" />
          <xs:element ref="total_ext_length" />
        </xs:sequence>
      </xs:choice>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 12 box element -->
<!-- followings need part 12 -->
<xs:element name="sch1">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:choice>
        <!-- for Decryption -->
        <xs:sequence>
          <xs:element ref="box_protected" />
          <xs:choice>
            <xs:element ref="bcip" />
            <xs:element ref="scip" />
          </xs:choice>
          <xs:element ref="gran" />
        </xs:sequence>
        <!-- for Authentication -->
        <xs:sequence>
          <xs:element ref="auth" />
          <xs:element ref="gran"
            minOccurs="0" />
        </xs:sequence>
      </xs:choice>
      <xs:element ref="vall" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="bcip">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="cipher_id" />
      <xs:element ref="cipher_mode" />
      <xs:element ref="padding_mode" />
      <xs:element ref="size" />
      <xs:element ref="key" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="scip">
  <xs:complexType>
```

```
<xs:attributeGroup ref="attrs.box"
  use="required" />
  <xs:sequence>
    <xs:element ref="type" />
    <xs:element ref="cipher_id" />
    <xs:element ref="key" />
  </xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="auth">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="method_id" />
      <xs:element ref="hash_id" />
      <xs:element ref="size" />
      <xs:element ref="key" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="key">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="size" />
      <xs:element ref="key_info" />
      <xs:element ref="gran"
        minOccurs="0" />
      <xs:element ref="vall" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="gran">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="granularity" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="vall">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="size" />
      <xs:element ref="num_entries" />
      <xs:element ref="count"
        maxOccurs="unbounded" />
      <xs:element ref="value"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ides">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="dest" />
        <xs:element ref="item_id" />
        <xs:element ref="desd" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

```

<xs:element name="dest">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="type" />
      <xs:element ref="version" />
      <xs:element ref="location" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="vide">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="layer start" />
      <xs:element ref="layer count" />
      <xs:element ref="res_start" />
      <xs:element ref="res_count" />
      <xs:element ref="hori_offset" />
      <xs:element ref="hori_lenght" />
      <xs:element ref="vert_offset" />
      <xs:element ref="vert_length" />
      <xs:element ref="colour" />
      <xs:element ref="time_start" />
      <xs:element ref="time_length" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="j2ke">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="vide"
        minOccurs="0" />
      <xs:element ref="tile start" />
      <xs:element ref="tile count" />
      <xs:element ref="precinct_start" />
      <xs:element ref="precinct count" />
      <xs:element ref="j2k_packet_start" />
      <xs:element ref="j2k packet count" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="icor">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="item id" />
      <xs:element ref="desc id" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="port">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="resolution" />
      <xs:element ref="layer" />
      <xs:element ref="cropped width" />
      <xs:element ref="cropped_height" />
      <xs:sequence minOccurs="0" >
        <xs:element ref="startx" />
        <xs:element ref="srarty" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="attr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="resolution" />
      <xs:element ref="layer" />
      <xs:element ref="cropped width" />
      <xs:element ref="cropped_height" />
      <xs:sequence minOccurs="0" >

```

```

      <xs:element ref="startx" />
      <xs:element ref="srarty" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="scs">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="width" />
      <xs:element ref="height" />
      <xs:element ref="hori_resolution" />
      <xs:element ref="vert_resolution" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="name" />
      <xs:element ref="depth" />
      <xs:element ref="predefined" />
      <xs:element ref="clap" minOccurs="0" />
      <xs:element ref="pasp" minOccurs="0" />
      <xs:element ref="resolution" />
      <xs:element ref="layer" />
      <xs:element ref="cropped width" />
      <xs:element ref="cropped_height" />
      <xs:sequence minOccurs="0" >
        <xs:element ref="startx" />
        <xs:element ref="srarty" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="dces">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />
    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="width" />
      <xs:element ref="height" />
      <xs:element ref="hori_resolution" />
      <xs:element ref="vert_resolution" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="name" />
      <xs:element ref="depth" />
      <xs:element ref="predefined" />
      <xs:element ref="clap" minOccurs="0" />
      <xs:element ref="pasp" minOccurs="0" />
      <xs:element ref="resolution" />
      <xs:element ref="layer" />
      <xs:element ref="cropped width" />
      <xs:element ref="cropped_height" />
      <xs:sequence minOccurs="0" >
        <xs:element ref="startx" />
        <xs:element ref="srarty" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<!-- part 1 content element -->
<!-- part 8 content element -->
<xs:element ref="type_flag" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="size_flag" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="location flag"
  type="xs:integer">

```

```

<xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="reserved" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="offset_size"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="box length" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="box type" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="box ext length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="offset" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="total length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="total ext length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<!-- part 12 box element -->
<!-- followings need part 12 -->
<xs:element ref="box protected"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="cipher id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="method id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="hash id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="cipher mode"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="padding mode"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="size" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

```

```

<xs:element ref="key info" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="granularity"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="num entries" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="count" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="value" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="item id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="layer start"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="layer_count"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="res start" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="res count" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="hori offset"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="hori length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="vert offset"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="vert length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="time_start" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

<xs:element ref="time_length"
type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
use="required" />
</xs:element>

```

```

</xs:element>

<xs:element ref="tile start" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="tile count" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="precinct start"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="precinct count"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="j2k_packet_start"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="j2k packet count"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="item_id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="desc_id" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="reserved" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

```

<xs:element ref="predefined" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="hori_resolution"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="vert resolution"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="resolution" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="layer" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="cropped width"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="cropped height"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="startx" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element ref="srarty" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

```

### A.3.7 Example of an XML schema for a JPEG 2000 Part 12 image (motion image)

```

<!-- part 12 box element -->
<xs:element name="mdat">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="free">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="skip">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="data" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="pdin">
  <xs:complexType>

```

```

    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="rate" />
        <xs:element ref="inital_delay" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="moov">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="mvhd" />
      <xs:element ref="trak"
        maxOccurs="unbounded" />
      <xs:element ref="mvex" minOccurs="0" />
      <xs:element ref="udta" minOccurs="0" />
      <xs:element ref="meta" minOccurs="0" />
      <xs:element ref="meco" minOccurs="0" />
      <xs:element ref="ipmc" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="mvhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"

```

```

        use="required" />
<xs:sequence>
  <xs:element ref="version" />
  <xs:element ref="flag" />
  <xs:element ref="creation_time" />
  <xs:element ref="modification_time" />
  <xs:element ref="time_scale" />
  <xs:element ref="duration" />
  <xs:element ref="rate" />
  <xs:element ref="volume" />
  <xs:element ref="reserved" />
  <xs:element ref="matrix" />
  <xs:element ref="predefined" />
  <xs:element ref="next_track_id" />
</xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="trak">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="tkhd" />
      <xs:element ref="mdia" />
      <xs:element ref="tref" minOccurs="0" />
      <xs:element ref="edts" minOccurs="0" />
      <xs:element ref="udta" minOccurs="0" />
      <xs:element ref="meta" minOccurs="0" />
      <xs:element ref="meco" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="tkhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="creation_time" />
      <xs:element ref="modification_time" />
      <xs:element ref="track_id" />
      <xs:element ref="reserved" />
      <xs:element ref="duration" />
      <xs:element ref="reserved" />
      <xs:element ref="layer" />
      <xs:element ref="alternate_group" />
      <xs:element ref="volume" />
      <xs:element ref="reserved" />
      <xs:element ref="matrix" />
      <xs:element ref="width" />
      <xs:element ref="height" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="tref">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:choice>
        <xs:element ref="hint" />
        <xs:element ref="cdsc" />
        <xs:element ref="hind" />
      </xs:choice>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="hint">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="track_id" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="cdsc">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>

```

```

      <xs:element ref="track_id" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="hind">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="track_id" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="mdia">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="mdhd" />
      <xs:element ref="hdlr" />
      <xs:element ref="minf" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="mdhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="creation_time" />
      <xs:element ref="modification_time" />
      <xs:element ref="time_scale" />
      <xs:element ref="duration" />
      <xs:element ref="language" />
      <xs:element ref="predefined" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="hdlr">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="predefined" />
      <xs:element ref="hdlr_type" />
      <xs:element ref="reserved" />
      <xs:element ref="name" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="minf">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:choice>
        <xs:element ref="vmhd" />
        <xs:element ref="smhd" />
        <xs:element ref="hmhd" />
        <xs:element ref="nmhd" />
      </xs:choice>
      <xs:element ref="stbl" />
      <xs:element ref="dinf" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="vmhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="graphic_mode" />
      <xs:element ref="op_code" />
    </xs:sequence>
  </xs:complexType>

```

```

</xs:element>

<xs:element name="smhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="balance" />
      <xs:element ref="reserved" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="hmhd">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="max pdu size" />
      <xs:element ref="avg pdu size" />
      <xs:element ref="max bitrate" />
      <xs:element ref="avg bitrate" />
      <xs:element ref="reserved" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stbl">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="stsd" />
      <xs:element ref="stdp" minOccurs="0" />
      <xs:element ref="ctts" />
      <xs:element ref="stss" minOccurs="0" />
      <xs:element ref="stsh" minOccurs="0" />
      <xs:element ref="sdtg" minOccurs="0" />
      <xs:choice>
        <xs:element ref="stsz" />
        <xs:element ref="stz2" />
      </xs:choice>
      <xs:element ref="stsc" />
      <xs:choice>
        <xs:element ref="stco" />
        <xs:element ref="co64" />
      </xs:choice>
      <xs:element ref="padb" minOccurs="0" />
      <xs:element ref="subs" minOccurs="0" />
      <xs:element ref="sbgp" minOccurs="0"
        maxOccurs="unbounded" />
      <xs:element ref="sgpd" minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="btrt">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="buffer size" />
      <xs:element ref="max bitrate" />
      <xs:element ref="avg_bitrate" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="metx">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="content_encoding" />
      <xs:element ref="namespace" />
      <xs:element ref="location" />
      <xs:element ref="btrt"
        minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>

```

```

</xs:complexType>
</xs:element>

<xs:element name="mett">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="content encoding" />
      <xs:element ref="mine_format" />
      <xs:element ref="btrt"
        minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="pasp">
  <xs:complexType>
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      use="required" />

    <xs:sequence>
      <xs:element ref="hori_spacing" />
      <xs:element ref="vert_spacing" />
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  </xs:complexType>
</xs:element>

<xs:element name="clap">
  <xs:complexType>
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      use="required" />

    <xs:sequence>
      <xs:element ref="width_num" />
      <xs:element ref="width_den" />
      <xs:element ref="height_num" />
      <xs:element ref="height_den" />
      <xs:element ref="hori_offset_num" />
      <xs:element ref="hori_offset_den" />
      <xs:element ref="vert_offset_num" />
      <xs:element ref="vert_offset_den" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stsd">
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    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="mjp2" />
        <xs:element ref="raw" />
        <xs:element ref="twos" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="VideoCoding4CC">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data_reference" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="width" />
      <xs:element ref="height" />
      <xs:element ref="hori_resolution" />
      <xs:element ref="vert_resolution" />
      <xs:element ref="reserved" />
      <xs:element ref="predefined" />
      <xs:element ref="name" />
      <xs:element ref="depth" />
      <xs:element ref="predefined" />
      <xs:element ref="clap" minOccurs="0" />
      <xs:element ref="pasp" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>

```

```

</xs:element>

<xs:element name="AudioCoding4CC">
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      use="required" />

    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="reserved" />
      <xs:element ref="channel count" />
      <xs:element ref="sample_size" />
      <xs:element ref="predefined" />
      <xs:element ref="reserved" />
      <xs:element ref="sample_rate" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stdp">
  <xs:complexType>
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      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="priority" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stts">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="sample count" />
        <xs:element ref="sample_delta" />
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    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="ctts">
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      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="sample count" />
        <xs:element ref="sample offset" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stss">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="sample number" />
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    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stsh">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">

```

```

      <xs:element
        ref="shadowed sample number"
      />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="sdtp">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="reserved" />
        <xs:element ref="sample depends on" />
        <xs:element ref="sample_is_depends_on" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="edts">
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      use="required" />

    <xs:sequence>
      <xs:element ref="elst"
        minOccurs="0" />
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  </xs:complexType>
</xs:element>

<xs:element name="elst">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="duration" />
        <xs:element ref="media time" />
        <xs:element ref="media rate integer" />
        <xs:element ref="media_rate_fraction" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="dinf">
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    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:choice>
        <xs:element ref="dref" />
        <xs:element ref="url " />
        <xs:element ref="urn_ " />
      </xs:choice>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="url ">
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    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
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    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="urn_">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

```

```

<xs:sequence>
  <xs:element ref="version" />
  <xs:element ref="flag" />
  <xs:element ref="name" />
  <xs:element ref="location" />
</xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="dref">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:choice>
          <xs:element ref="url_" />
          <xs:element ref="urn" />
        </xs:choice>
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stsz">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="sample_size" />
      <xs:element ref="num_entries" />
      <xs:element ref="entry_size"
        minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stz2">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="reserved" />
      <xs:element ref="field_size" />
      <xs:element ref="num_entries" />
      <xs:element ref="entry_size"
        minOccurs="0"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stsc">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="first_chunk" />
        <xs:element ref="sample_per_chunk" />
        <xs:element ref="description_index" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="stco">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:element ref="chunk_offset"
        maxOccurs="unbounded" />

```

```

</xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="co64">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:element ref="chunk_offset"
        maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="padb">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="pad1" />
      <xs:element ref="pad2" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="subs">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.box"
      use="required" />

    <xs:sequence>
      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
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        <xs:element ref="sample_delta" />
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        <xs:element ref="sample flags" />
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  </xs:complexType>
</xs:element>

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    <xs:sequence>
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</xs:element>

<xs:element name="maxr">
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      use="required" />

    <xs:sequence>

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      <xs:element ref="period" />
      <xs:element ref="bytes sent" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="hnti">
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    <xs:sequence>
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      <xs:element ref="count" />
      <xs:element ref="rtmpmap" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

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    <xs:sequence>
      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
      <xs:element ref="track version" />
      <xs:element ref="compatible version" />
      <xs:element ref="partition entry id" />
      <xs:element ref="REC overhead" />
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</xs:element>

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    <xs:sequence>
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        maxOccurs="unbounded" />
      <xs:element ref="extr"
        minOccurs="0" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

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    <xs:sequence>
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      <xs:element ref="extension size" />
      <xs:element ref="extension" />
      <xs:element ref="packet size" />
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    </xs:sequence>
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</xs:element>

<xs:element name="extr">
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      use="required" />

    <xs:sequence>
      <xs:element ref="data" />
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  </xs:complexType>
</xs:element>

<!-- part 12 content element -->

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</xs:element>

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<xs:element name="trun index size"
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<xs:element name="moof offset"
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    use="required" />
</xs:element>

<xs:element name="time" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="period" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="bytes_sent"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="payload id"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="count" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="rtpmap" type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>

<xs:element name="partition entry id"
  type="xs:integer">

```

```
<xs:attributeGroup ref="attrs.int"
  use="required" />
</xs:element>
<xs:element name="FEC_overhead"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>
<xs:element name="header"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>
<xs:element name="extension_size"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
```

```
</xs:element>
<xs:element name="extension"
  type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>
<xs:element name="packet size"
  type="xs:integer">
  <xs:attributeGroup ref="attrs.int"
    use="required" />
</xs:element>
<xs:element name="packet" type="hexbyte">
  <xs:attributeGroup ref="attrs.hex"
    use="required" />
</xs:element>
```

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## Annex B

## JPXML elements for codestream marker segments

(This annex forms an integral part of this Recommendation | International Standard.)

## B.1 Introduction

This annex provides the predefined marker element name, content element names, and length and type attributes for the JPEG 2000 family codestream. The marker element appearance and structure shall be in conformity with Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.801 | ISO/IEC 15444-2, Rec. ITU-T T.807 | ISO/IEC 15444-8, Rec. ITU-T T.809 | ISO/IEC 15444-10 and Rec. ITU-T T.810 | ISO/IEC 15444-11.

## B.2 JPEG 2000 codestream marker element definitions

This subclause includes many tables of the marker's content element definitions, and these tables define the content element name, the content data length in byte, and the content data type. The JPXML data types are described in 7.5. Some tables define the sub-content element names of a defined content element, and some marker or content elements have content element definitions of two or more types. For more detailed information of the meaning and structure of this marker segment content, see each Recommendation | International Standard cited in clause B.1.

## B.2.1 JPEG 2000 Part 1 marker elements

The JPEG 2000 part 1 marker elements shall be used as the element names described in Table B.1. These marker content element names are defined in Tables B.2 to B.19.

Table B.1 – JPEG 2000 Part 1 markers

| Marker name                                      | Element name | Code   | Size         | Main header            | Tile-part header                       |
|--------------------------------------------------|--------------|--------|--------------|------------------------|----------------------------------------|
| <b>Delimiting markers and marker segments</b>    |              |        |              |                        |                                        |
| Start of codestream                              | SOC          | 0xFF4F | 2            | required <sup>a</sup>  | not allowed                            |
| Start of tile-part                               | SOT          | 0xFF90 | 12           | not allowed            | required                               |
| Start of data                                    | SOD          | 0xFF93 | 2            | not allowed            | last marker                            |
| End of codestream                                | EOC          | 0xFFD9 | 2            | not allowed            | not allowed                            |
| <b>Fixed information marker segments</b>         |              |        |              |                        |                                        |
| Image and tile size                              | SIz          | 0xFF51 | 43 to 49,192 | required               | not allowed                            |
| <b>Functional marker segments</b>                |              |        |              |                        |                                        |
| Coding style default                             | COD          | 0xFF52 | 14 to 47     | required               | optional                               |
| Coding style component                           | COC          | 0xFF53 | 11 to 45     | optional               | optional                               |
| Region-of-interest                               | RGN          | 0xFF5E | 7 to 8       | optional               | optional                               |
| Quantization default                             | QCD          | 0xFF5C | 6 to 199     | required               | optional                               |
| Quantization component                           | QCC          | 0xFF5D | 7 to 201     | optional               | optional                               |
| Progression order change                         | POC          | 0xFF5F | 11 to 65,537 | optional               | optional                               |
| <b>Pointer marker segments</b>                   |              |        |              |                        |                                        |
| Tile-part lengths                                | TLM          | 0xFF55 | 8 to 65,537  | optional               | not allowed                            |
| Packet length, main header                       | PLM          | 0xFF57 | 6 to 65,537  | optional               | not allowed                            |
| Packet length, tile-part header                  | PLT          | 0xFF58 | 6 to 65,537  | not allowed            | optional                               |
| Packed packet headers, main header               | PPM          | 0xFF60 | 9 to 65,537  | optional               | not allowed                            |
| Packed packet headers, tile-part header          | PPT          | 0xFF61 | 6 to 65,537  | not allowed            | optional                               |
| <b>In-bit-stream markers and marker segments</b> |              |        |              |                        |                                        |
| Start of packet                                  | SOP          | 0xFF91 | 6            | not allowed            | not allowed<br>optional in-bitstream   |
| End of packet header                             | EPH          | 0xFF92 | 2            | optional<br>inside PPM | optional inside PPT<br>or in-bitstream |
| <b>Informational marker segments</b>             |              |        |              |                        |                                        |
| Component registration                           | CRG          | 0xFF63 | 8 to 65,536  | optional               | not allowed                            |
| Comment                                          | COM          | 0xFF64 | 7 to 65,537  | optional               | optional                               |

**Table B.2 – Content element names for SOT**

| content | length | type    | loop |
|---------|--------|---------|------|
| Isot    | 2      | integer |      |
| Psot    | 4      | integer |      |
| TPsot   | 1      | integer |      |
| TNsot   | 1      | integer |      |

**Table B.3 – Content element names for SIZ**

| content | length | type    | loop |
|---------|--------|---------|------|
| Rsiz    | 2      | integer |      |
| Xsiz    | 4      | integer |      |
| Ysiz    | 4      | integer |      |
| OXsiz   | 4      | integer |      |
| OYSiz   | 4      | integer |      |
| XTsiz   | 4      | integer |      |
| YTsiz   | 4      | integer |      |
| XTOsiz  | 4      | integer |      |
| YTOsiz  | 4      | integer |      |
| Csiz    | 2      | integer |      |
| Ssiz    | 1      | integer |      |
| XRsiz   | 1      | integer |      |
| YRsiz   | 1      | integer |      |

**Table B.4 – Content element names for COD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Scod    | 1      | hexbyte |      |
| SGcod   | 4      | hexbyte |      |
| SPcod   | 5 – 43 | hexbyte | □    |

**Table B.5 – Content element names for COC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ccoc    | 1, 2   | hexbyte |      |
| Scoc    | 1      | hexbyte |      |
| SPcoc   | 5 – 43 | hexbyte | □    |

**Table B.6 – Content element names for SGcod**

| SGcod       | length | type    | loop |
|-------------|--------|---------|------|
| progression | 1      | integer |      |
| num_layers  | 2      | integer |      |
| colour_conv | 1      | integer |      |

**Table B.7 – Content element names for SPcod/SPcoc**

| SPcod/SPcoc | length | type    | loop |
|-------------|--------|---------|------|
| num_levels  | 1      | integer |      |
| xcb         | 1      | integer |      |
| ycb         | 1      | integer |      |
| style       | 1      | integer |      |
| wavelet     | 1      | integer |      |
| ppy         | 1/2    | integer | □    |
| ppx         | 1/2    | integer |      |

**Table B.8 – Content element names for RGN**

| content | length | type    | loop |
|---------|--------|---------|------|
| Crgn    | 1, 2   | integer |      |
| Srgn    | 1      | integer |      |
| SPrgn   | 1      | integer |      |

**Table B.9 – Content element names for QCD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Sqcd    | 1      | integer |      |
| SPqcd   | 1, 2   | integer | □    |

**Table B.10 – Content element names for QCC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Cqcc    | 1      | integer |      |
| Sqcc    | 1      | integer |      |
| SPqcc   | 1, 2   | integer | □    |

**Table B.11 – Content element names for POC**

| content | length | type    | loop |
|---------|--------|---------|------|
| RSpoc   | 1      | integer | □    |
| CSpoc   | 1, 2   | integer |      |
| LYEpoc  | 2      | integer |      |
| REpoc   | 1      | integer |      |
| CEpoc   | 1, 2   | integer |      |
| Ppoc    | 1      | integer |      |

**Table B.12 – Content element names for TLM**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ztlm    | 1      | integer |      |
| Stlm    | 1      | integer |      |
| Ttlm    | 0 – 2  | integer | □    |
| Ptlm    | 0 – 1  | integer |      |

**Table B.13 – Content element names for PLM**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Zplm    | 1        | integer | □    |
| Nplm    | 1        | integer |      |
| lplm    | 0-65,531 | integer |      |

**Table B.14 – Content element names for PLT**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Zplt    | 1        | integer |      |
| lplt    | 0-65,531 | integer | □    |

**Table B.15 – Content element names for PPM**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Zppm    | 1        | integer |      |
| Nppm    | 2        | integer | □    |
| lppm    | 0-65,531 | integer |      |

**Table B.16 – Content element names for PPT**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Zppt    | 1        | integer |      |
| lppt    | 0-65,531 | integer | □    |

**Table B.17 – Content element names for SOP**

| content | length | type    | loop |
|---------|--------|---------|------|
| Nsop    | 2      | integer |      |

**Table B.18– Content element names for CRG**

| content | length | type    | loop |
|---------|--------|---------|------|
| Xcrg    | 2      | integer | ]    |
| Ycrg    | 2      | integer |      |

**Table B.19 – Content element names for COM**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Rcom    | 1        | integer |      |
| Ccom    | 1-65,531 | string  |      |

**B.2.2 JPEG 2000 Part 2 marker elements**

The extended and additional JPEG 2000 Part 2 marker elements shall be used as the element names described in Table B.20. These marker content element names are defined in Tables B.21 to B.38.

**Table B.20 – JPEG 2000 Part 2 extended and additional markers**

| Marker name                                  | Element name | Code   | Size         | Main header | Tile-part header |
|----------------------------------------------|--------------|--------|--------------|-------------|------------------|
| Start of tile-part (part 1 extended)         | SOT          | 0xFF90 | 14           | not allowed | required         |
| Coding style default (part 1 extended)       | COD          | 0xFF52 | 14 to 47     | required    | optional         |
| Coding style component (part 1 extended)     | COC          | 0xFF53 | 11 to 45     | optional    | optional         |
| Region-of-interest (part 1 extended)         | RGN          | 0xFF5E | 7 to 24      | optional    | optional         |
| Variable DC offset                           | DCO          | 0xFF70 | 7 to 32,772  | optional    | optional         |
| Visual masking                               | VMS          | 0xFF71 | 11           | optional    | optional         |
| Downsampling factor style                    | DFS          | 0xFF72 | 7 to 65,537  | optional    | optional         |
| Arbitrary decomposition style                | ADS          | 0xFF73 | 5 to 65,537  | optional    | optional         |
| Arbitrary transformation kernels             | ATK          | 0xFF79 | 11 to 65,537 | optional    | optional         |
| Component bit depth                          | CBD          | 0xFF78 | 7 to 16,390  | optional    | optional         |
| Multiple component transformation definition | MCT          | 0xFF74 | 8 to 65,537  | optional    | optional         |
| Multiple component collection                | MCC          | 0xFF75 | 7 to 65,537  | optional    | optional         |
| Multiple component transformation ordering   | MCO          | 0xFF77 | 3 to 260     | optional    | optional         |
| Non-linearity point transformation           | NLT          | 0xFF76 | 14 to 65,537 | optional    | optional         |
| Quantization default, precinct               | QPD          | 0xFF5A | 8 to 103     | optional    | optional         |
| Quantization component, precinct             | QPC          | 0xFF5B | 7 to 201     | optional    | optional         |

**Table B.21 – Content element names for SOT**

| content     | length   | type           | loop |
|-------------|----------|----------------|------|
| Isot        | 2        | integer        |      |
| <b>Psot</b> | <b>4</b> | <b>integer</b> |      |
| TPsot       | 2        | integer        |      |
| TNsot       | 2        | integer        |      |

**Table B.22 – Content element names for COD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Scod    | 1      | hexbyte |      |
| SGcod   | 4      | hexbyte |      |
| SPcod   | 7 – 45 | hexbyte | ]    |

**Table B.23 – Content element names for COC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ccoc    | 1, 2   | hexbyte |      |
| Scoc    | 1      | hexbyte |      |
| SPcoc   | 7 – 45 | hexbyte | ]    |

**Table B.24 – Content element names for Spcod/SPcoc**

| SPcod/SPcoc | length | type    | loop |
|-------------|--------|---------|------|
| num_levels  | 1      | integer |      |
| xcb         | 1      | integer |      |
| ycb         | 1      | integer |      |
| style       | 1      | integer |      |
| wavelet     | 1      | integer |      |
| ss0         | 2      | integer |      |
| ppy         | 1/2    | integer | ]    |
| ppx         | 1/2    | integer |      |

**Table B.25 – Content element names for RGN**

| content | length | type    | loop |
|---------|--------|---------|------|
| Crng    | 1, 2   | integer |      |
| Srgn    | 1      | integer |      |
| SPrgn   | 17     | integer |      |

**Table B.26 – Content element names for SPrgn**

| SPrgn | length | type    | loop |
|-------|--------|---------|------|
| shift | 1      | integer |      |
| XArgn | 4      | integer |      |
| YArgn | 4      | integer |      |
| XBrng | 4      | integer |      |
| YBrng | 4      | integer |      |

**Table B.27 – Content element names for DCO**

| content | length | type    | loop |
|---------|--------|---------|------|
| Sdco    | 1      | integer |      |
| SPdco   | 1      | integer | □    |

**Table B.28 – Content element names for VMS**

| content | length | type    | loop |
|---------|--------|---------|------|
| Cvms    | 2      | integer |      |
| Svm     | 1      | integer |      |
| Wvms    | 1      | integer |      |
| Rvm     | 1      | integer |      |
| Avms    | 1      | integer |      |
| Bvms    | 1      | integer |      |

**Table B.29 – Content element names for DFS**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Sdfs    | 2        | integer |      |
| ldfs    | 1        | integer |      |
| Ddfs    | 0-65,530 | integer |      |

**Table B.30 – Content element names for ADS**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Sads    | 1        | integer |      |
| IOads   | 1        | integer |      |
| DOads   | 0-65,530 | string  |      |
| ISads   | 1        | integer |      |
| DSads   | 0-65,530 | string  |      |

**Table B.31 – Content element names for ATK**

| content | length            | type    | loop |
|---------|-------------------|---------|------|
| Satk    | 2                 | integer |      |
| Katk    | 0, 1, 2, 4, 8, 16 | integer |      |
| Natk    | 1                 | integer |      |
| Oatk    | 0, 1              | integer |      |
| Eatk    | 0, 1              | string  |      |
| Batk    | 0, 1, 2, 4, 8, 16 | integer |      |
| LCatk   | 1                 | integer |      |
| Aatk    | 1, 2, 4, 8, 16    | integer | □    |

**Table B.32 – Content element names for CBD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ncbd    | 2      | integer |      |
| BDcbd   | 1      | integer | □    |

**Table B.33 – Content element names for MCO**

| content | length | type    | loop |
|---------|--------|---------|------|
| Nmco    | 1      | integer |      |
| Imco    | 1      | integer | □    |

**Table B.34 – Content element names for NLT**

| content | length | type    | loop |
|---------|--------|---------|------|
| Cnlt    | 2      | integer |      |
| BDnlt   | 1      | integer |      |
| Tnlt    | 1      | integer |      |
| STnlt   | 1      | integer | □    |

**Table B.35 – Content element names for QPD**

| content | length | type    | loop |
|---------|--------|---------|------|
| PLqpd   | 2      | integer |      |
| PPqpd   | 1, 2   | integer |      |
| Sqpd    | 1      | integer |      |
| SPqpd   | 1      | integer | □    |

**Table B.36 – Content element names for QPC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Cqpc    | 1, 2   | integer |      |
| PLqpc   | 2      | integer |      |
| PPqpc   | 1, 2   | integer |      |
| Sqpc    | 1      | integer |      |
| SPqpc   | 1      | integer | □    |

**Table B.37 – Content element names for MCT**

| content | length | type    | loop |
|---------|--------|---------|------|
| Zmct    | 2      | integer |      |
| Imct    | 2      | integer |      |
| Ymct    | 0, 2   | integer |      |
| SPmct   | 2      | integer | □    |

**Table B.38 – Content element names for MCC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Zmcc    | 2      | integer |      |
| Imcc    | 1      | integer |      |
| Ymcc    | 0, 2   | integer |      |
| Qmcc    | 1      | integer |      |
| Xmcc    | 1      | integer |      |
| Nmcc    | 2      | integer |      |
| Cmcc    | 1, 2   | integer | □    |
| Mmcc    | 2      | integer |      |
| Wmcc    | 1, 2   | integer | □    |
| Tmcc    | 3      | integer |      |
| Omcc    | 4      | integer |      |

### B.2.3 JPEG 2000 Part 8 marker elements

The extended and additional JPEG 2000 Part 8 marker elements shall be used as the element names described in Table B.39. These marker content element names are defined in Tables B.40 to B.55.

**Table B.39 – JPEG 2000 Part 8 additional marker**

| Marker name                   | Element name | Code   | Size        | Main header | Tile-part header                     |
|-------------------------------|--------------|--------|-------------|-------------|--------------------------------------|
| Main security marker          | SEC          | 0xFF65 | 4 to 65,537 | optional    | optional                             |
| In-codestream security marker | INSEC        | 0xFF94 | 4 to 65,537 | not allowed | not allowed<br>optional in-bitstream |

**Table B.40 – Content element names for SEC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Zsec    | 8 -    | integer |      |
| Psec    | 0, 7 - | hexbyte |      |
| Tool    | 0 -    | hexbyte | □    |

**Table B.41 – Content element names for INSEC**

| content | length   | type    | loop |
|---------|----------|---------|------|
| index   | 8 -      | integer |      |
| Rinsec  | 0, 7 -   | hexbyte |      |
| APinsec | variable | hexbyte |      |

**Table B.42 – Content element names for Psec**

| Psec   | length | type    | loop |
|--------|--------|---------|------|
| Fpsec  | 1 -    | hexbyte |      |
| Ntools | 1+n    | integer |      |
| lmax   | 1+n    | integer |      |
| Ptrlcp | 0, 4   | hexbyte |      |

**Table B.43 – Content element names for Tool**

| Tool   | length   | type    | loop |
|--------|----------|---------|------|
| type   | 1+n      | integer |      |
| index  | 1+n      | integer |      |
| IDtool | 1+n      | hexbyte |      |
| length | 2+n      | integer |      |
| ZOI    | variable | hexbyte |      |
| LPid   | 2+n      | integer |      |
| Pid    | variable | hexbyte |      |

**Table B.44 – Content element names for IDtool**

| IDtool<br>(Non-normative Tool) | length | type    | loop |
|--------------------------------|--------|---------|------|
| IDraid                         | 1+n    | integer |      |
| IDransl                        | 1+n    | integer |      |
| IDrans                         | 0, 4   | hexbyte |      |

**Table B.45 – Content element names for ZOI**

| ZOI   | length   | type    | loop |
|-------|----------|---------|------|
| NZzoi | 1+n      | integer |      |
| Zone  | variable | hexbyte | □    |

**Table B.46 – Content element names for Zone**

| Zone  | length   | type    | loop |
|-------|----------|---------|------|
| DCzoi | variable | integer |      |
| Pzoi  | variable | hexbyte | □    |

**Table B.47 – Content element names for Pzoi**

| Pzoi | length   | type    | loop |
|------|----------|---------|------|
| Mzoi | variable | hexbyte |      |
| Nzoi | 0, 1+n   | integer |      |
| lzoi | variable | hexbyte | □    |

**Table B.48 – Content element names for Pid**

| Pid<br>(Normative Tool) | length | type    | loop |
|-------------------------|--------|---------|------|
| NTid                    | 1+n    | integer |      |
| NTdomain                | 1+n    | integer |      |
| NTgranularity           | 3      | integer |      |
| NTvalue                 | 0, 4   | hexbyte |      |

**Table B.49 – Content element names for NTdomain**

| NTdomain | length   | type    | loop |
|----------|----------|---------|------|
| PD       | variable | hexbyte |      |
| Fpd      | variable | hexbyte |      |

**Table B.50 – Content element names for NTgranularity**

| NTgranularity | length | type    | loop |
|---------------|--------|---------|------|
| PD            | 2      | hexbyte |      |
| GL            | 1      | hexbyte |      |

**Table B.51 – Content element names for NTvalue**

| NTvalue | length   | type    | loop |
|---------|----------|---------|------|
| Nv      | 2+n      | integer |      |
| Sv      | 1+n      | integer |      |
| data    | variable | hexbyte |      |

**Table B.52 – Content element names for Tid**

| Tid<br>(Decryption Template) | length   | type    | loop |
|------------------------------|----------|---------|------|
| MEdecry                      | 1+n      | hexbyte |      |
| CTdecry                      | 2        | hexbyte |      |
| CPdecry                      | variable | hexbyte |      |

| Tid<br>(Authentication Temp.) | length   | type    | loop |
|-------------------------------|----------|---------|------|
| MEauth                        | 1+n      | hexbyte |      |
| Pauth                         | variable | hexbyte |      |

| Tid<br>(Hash Template) | length | type    | loop |
|------------------------|--------|---------|------|
| Hhash                  | 1      | hexbyte |      |
| SIZhash                | 1      | integer |      |

**Table B.53 – Content element names for CPdecry**

| CPdecry<br>(Block cipher) | length   | type    | loop |
|---------------------------|----------|---------|------|
| Mbc                       | 3/4      | hexbyte |      |
| Pbc                       | 1/4      | hexbyte |      |
| SIZbc                     | 1        | integer |      |
| KTntid                    | variable | hexbyte |      |

| CPdecry<br>(Stream cipher) | length   | type    | loop |
|----------------------------|----------|---------|------|
| KTntid                     | variable | hexbyte |      |

| CPdecry<br>(Asymmetric cipher) | length   | type    | loop |
|--------------------------------|----------|---------|------|
| KTntid                         | variable | hexbyte |      |

**B.2.4 JPEG 2000 Part 10 marker elements**

The extended and additional JPEG 2000 Part 10 marker elements shall be used as the element names described in Table B.56. These marker content element names are defined in Tables B.57 to B.65.

**Table B.56 – JPEG 2000 Part 10 extended and additional markers**

| Marker name                              | Element name | Code   | Size         | Main header | Tile-part header |
|------------------------------------------|--------------|--------|--------------|-------------|------------------|
| Coding style default (part 2 extended)   | COD          | 0xFF52 | 19 to 85     | required    | optional         |
| Coding style component (part 2 extended) | COC          | 0xFF53 | 20 to 104    | optional    | optional         |
| Region-of-interest (part 2 extended)     | RGN          | 0xFF5E | 7 to 32      | optional    | optional         |
| Component registration (part 1 extended) | CRG          | 0xFF63 | 10 to 65,536 | optional    | not allowed      |
| Additional dimension image and tile size | NSI          | 0xFF54 | 22 to 16,405 | required    | not allowed      |

**Table B.57 – Content element names for NSI**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ndim    | 1      | integer |      |
| Zsiz    | 4      | integer |      |
| ZOsiz   | 4      | integer |      |
| ZTsiz   | 5      | integer |      |
| ZTOsiz  | 4      | integer |      |
| ZRsiz   | 1      | integer | □    |

**Table B.54 – Content element names for Pauth**

| Pauth<br>(Hash-based Auth.) | length   | type    | loop |
|-----------------------------|----------|---------|------|
| Mhmac                       | 1        | hexbyte |      |
| Hhmac                       | 1        | hexbyte |      |
| KTntid                      | variable | hexbyte |      |
| SIZhmac                     | 2        | integer |      |

| Pauth<br>(Cipher-based Auth.) | length   | type    | loop |
|-------------------------------|----------|---------|------|
| CACmac                        | 1        | hexbyte |      |
| Ccmac                         | 1        | hexbyte |      |
| KTntid                        | variable | hexbyte |      |
| SIZcmac                       | 2        | integer |      |

| Pauth<br>(Digital Signature) | length   | type    | loop |
|------------------------------|----------|---------|------|
| Mds                          | 1        | hexbyte |      |
| Hds                          | 1        | hexbyte |      |
| KTntid                       | variable | hexbyte |      |
| SIZds                        | 2        | integer |      |

**Table B.55 – Content element names for KTntid**

| KTntid      | length   | type    | loop |
|-------------|----------|---------|------|
| LKkt        | 2        | hexbyte |      |
| KIDkt       | 1        | hexbyte |      |
| granularity | 3        | hexbyte |      |
| data        | variable | hexbyte |      |

**Table B.58 – Content element names for COD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Scod    | 1      | hexbyte |      |
| SGcod   | 4      | hexbyte |      |
| SPcod   | 10-76  | hexbyte | □    |

**Table B.59 – Content element names for COC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Ccoc    | 1, 2   | integer |      |
| Scoc    | 1      | hexbyte |      |
| SPcoc   | 10-94  | hexbyte | □    |

**Table B.60 – Content element names for SPcod/SPcoc**

| SPcod/SPcoc | length | type    | loop |
|-------------|--------|---------|------|
| num_xlevels | 1      | integer |      |
| num_ylevels | 1      | integer |      |
| num_zlevels | 1      | integer |      |
| xcb         | 1      | integer |      |
| ycb         | 1      | integer |      |
| zcb         | 1      | integer |      |
| style       | 1      | integer |      |
| xkernel     | 1      | integer |      |
| ykernel     | 1      | integer |      |
| zkernel     | 1      | integer |      |
| sso         | 2      | integer |      |
| reserved    | 1/2    | –       |      |
| ppz         | 1/2    | integer |      |
| ppy         | 1/2    | integer |      |
| ppx         | 1/2    | integer |      |

**Table B.61 – Content element names for QCD**

| content | length | type    | loop |
|---------|--------|---------|------|
| Sqcd    | 1      | integer |      |
| SPqcd   | 1, 2   | integer | □    |

**Table B.62 – Content element names for QCC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Cqcc    | 1      | integer |      |
| Sqcc    | 1      | integer |      |
| SPqcc   | 1, 2   | integer | □    |

**B.2.5 JPEG 2000 Part 11 marker elements**

The extended and additional JPEG 2000 Part 11 marker elements shall be used as the element names described in Table B.66. These marker content element names are defined in Tables B.67 to B.70.

**Table B.66 – JPEG 2000 Part 11 additional markers**

| Marker name                  | Element name | Code   | Size         | Main header | Tile-part header |
|------------------------------|--------------|--------|--------------|-------------|------------------|
| Error Protection Block       | EPB          | 0xFF66 | 13 to 65,537 | optional    | optional         |
| Error Sensitivity Descriptor | ESD          | 0xFF67 | 6 to 65,537  | optional    | optional         |
| Error Protection Capability  | EPC          | 0xFF68 | 11 to 65,537 | required    | optional         |
| Residual Errors Descriptor   | RED          | 0xFF69 | 6 to 65,537  | optional    | optional         |

**Table B.67 – Content element names for EPB**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Depb    | 1        | integer |      |
| LDPePB  | 4        | integer |      |
| PePB    | 4        | integer |      |
| data    | 0-65,524 | hexbyte |      |

**Table B.68 – Content element names for EPC**

| content | length | type    | loop |
|---------|--------|---------|------|
| Pcrc    | 2      | integer |      |
| DL      | 4      | integer |      |
| PePC    | 1      | integer |      |
| id      | 2      | hexbyte | 1    |
| Lid     | 2      | hexbyte |      |

**Table B.63 – Content element names for RGN**

| content | length | type    | loop |
|---------|--------|---------|------|
| Crgn    | 2      | integer |      |
| Srgn    | 1      | integer |      |
| SPrgn   | 25     | integer |      |

**Table B.64 – Content element names for SPRgn**

| SPrgn | length | type    | loop |
|-------|--------|---------|------|
| shift | 1      | integer |      |
| XArgn | 4      | integer |      |
| YArgn | 4      | integer |      |
| ZArgn | 4      | integer |      |
| XBrgn | 4      | integer |      |
| YBrgn | 4      | integer |      |
| ZBrgn | 4      | integer |      |

**Table B.65 – Content element names for CRG**

| content | length | type    | loop |
|---------|--------|---------|------|
| Xcrg    | 2      | integer | 1    |
| Ycrg    | 2      | integer |      |
| Zcrg    | 2      | integer |      |

**Table B.69 – Content element names for ESD**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Cesd    | 1, 2     | integer |      |
| Pesd    | 1        | integer |      |
| data    | 0-65,531 | hexbyte |      |

**Table B.70 – Content element names for RED**

| content | length   | type    | loop |
|---------|----------|---------|------|
| Pred    | 1        | integer |      |
| data    | 0-65,531 | hexbyte |      |

### B.3 Examples of XML schemas

The following examples are XML schemas for the marker elements of the JPEG 2000 family codestream.

#### B.3.1 Example of an XML schema for a common header

The following example is of common XML schemas for all marker types of JPEG 2000 family codestreams.

```
<?xml version="1.0" ?>
<xs:schema xmlns:xs="http://www.iso.org/jpeg/2001/XMLSchema"
  targetNamespace="http://www.iso.org/jpxml"
  xmlns="http://www.iso.org/jpxml">

  <xs:attributeGroup name="attrs.marker">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="offset" type="xs:integer" use="optional" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="marker" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>

  <xs:attributeGroup name="attrs.hex">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="hexbyte" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>

  <xs:attributeGroup name="attrs.int">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="integer" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>

  <xs:attributeGroup name="attrs.str">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="string" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>

  <xs:attributeGroup name="attrs.url">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="type" use="required">
      <xs:simpleType>
        <xs:restriction base="xs:string">
          <xs:enumeration value="location" />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:attributeGroup>

  <xs:attributeGroup name="attrs.root">
    <xs:attribute name="length" type="xs:integer" use="required" />
    <xs:attribute name="name" type="xs:anyURL" use="optional" />
  </xs:attributeGroup>

  <!-- add following XML Schemas for the JPXML document. -->
  ...

</xs:schema>
```

## B.3.2 Example of an XML schema for a JPEG 2000 Part 1 codestream (single image)

```

<!-- part 1 marker element -->
<xs:element name="SOT">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Isot" />
      <xs:element ref="Psot" />
      <xs:element ref="TPsot" />
      <xs:element ref="TNsot" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="SIZ">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Rsiz" />
      <xs:element ref="Xsiz" />
      <xs:element ref="Ysiz" />
      <xs:element ref="OXsiz" />
      <xs:element ref="OYsiz" />
      <xs:element ref="XTsiz" />
      <xs:element ref="YTtiz" />
      <xs:element ref="XTOsiz" />
      <xs:element ref="YTOsiz" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="Csiz" />
        <xs:element ref="XRsiz" />
        <xs:element ref="YRsiz" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="COD">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Scod" />
      <xs:element ref="SGcod" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="SPcod" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="COC">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Ccoc" />
      <xs:element ref="Scoc" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="SPcoc" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="SGcod">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
    <xs:sequence>
      <xs:element ref="progression" />
      <xs:element ref="num layers" />
      <xs:element ref="colour conv" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="SPcod">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_levels" />
      <xs:element ref="xcb" />
      <xs:element ref="ycb" />
      <xs:element ref="style" />
      <xs:element ref="wavelet" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="ppy" />
        <xs:element ref="ppx" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="SPcoc">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.hex"
      use="required" />
    <xs:sequence>
      <xs:element ref="num_levels" />
      <xs:element ref="xcb" />
      <xs:element ref="ycb" />
      <xs:element ref="style" />
      <xs:element ref="wavelet" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="ppy" />
        <xs:element ref="ppx" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="RGN">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Crgn" />
      <xs:element ref="Srgn" />
      <xs:element ref="SPrgn" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="QCD">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Sqcd" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="SPqcd" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="QCC">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence>
      <xs:element ref="Cqcc" />
      <xs:element ref="Sqcc" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="SPqcc" />
      </xs:sequence>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="POC">
  <xs:complexType>
    <xs:attributeGroup ref="attrs.marker"
      use="required" />
    <xs:sequence maxOccurs="unbounded">
      <xs:element ref="RSpoc" />
      <xs:element ref="CSpoc" />
      <xs:element ref="LYEoc" />
      <xs:element ref="REpoc" />
      <xs:element ref="CEpoc" />
      <xs:element ref="Ppoc" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

```