
**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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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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.

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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.

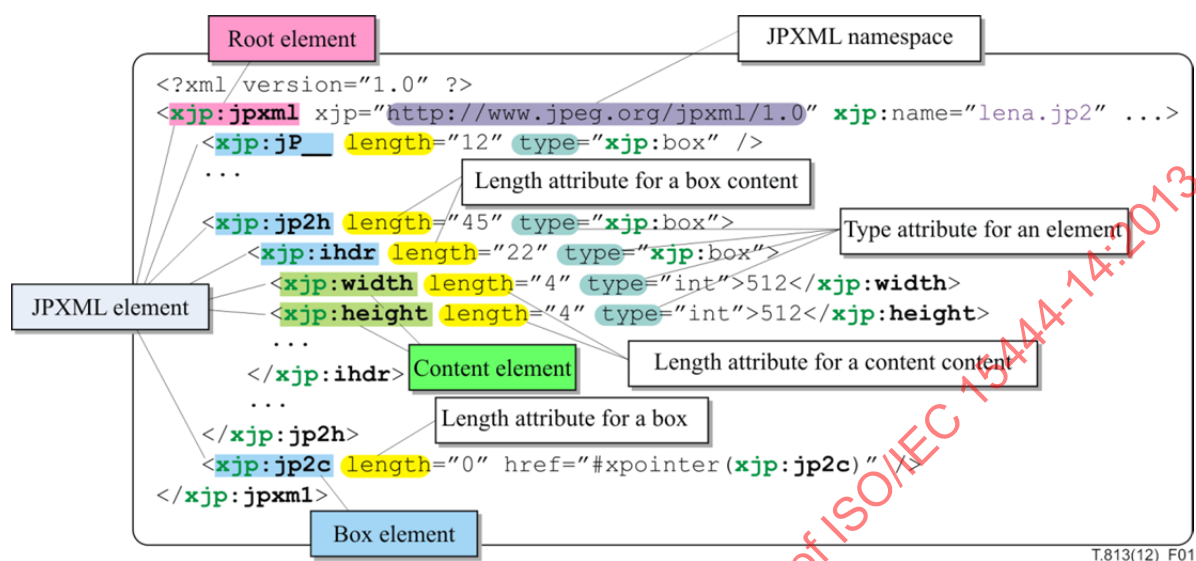


Figure 1 – Example of a JPXML document for a JPEG 2000 image

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.

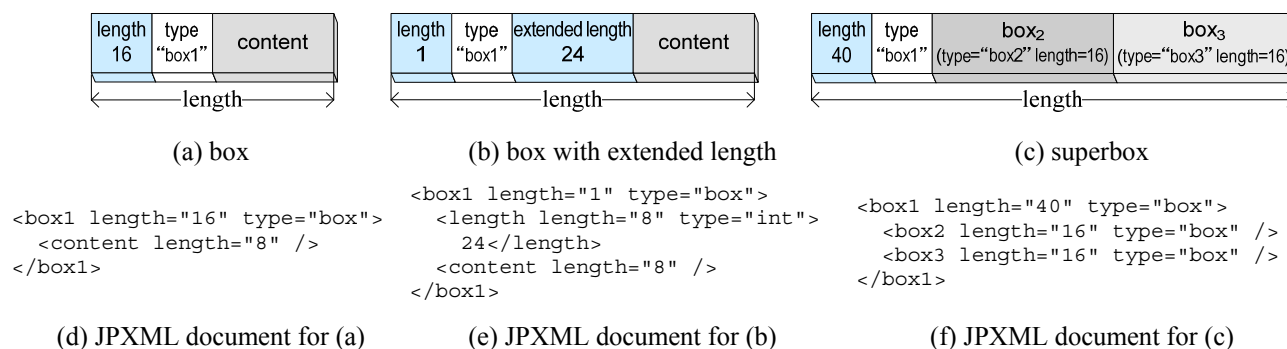


Figure 2 – Examples of box format and JPXML documents

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.

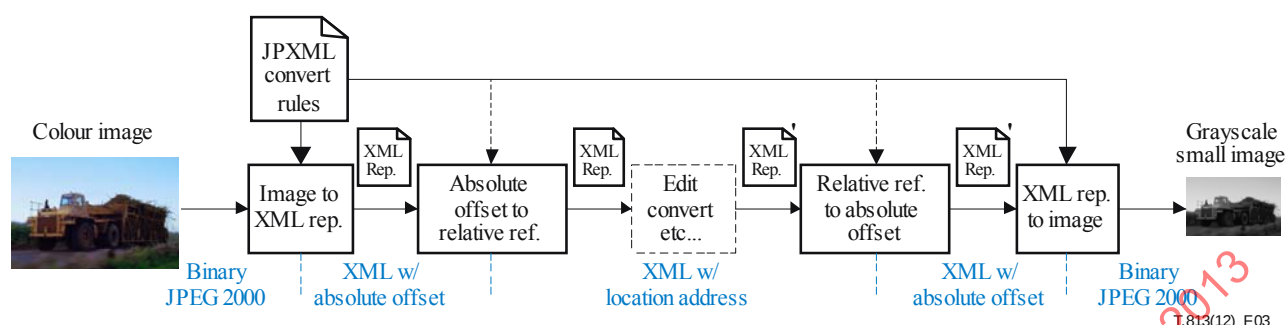


Figure 3 – Block diagram of image converting with JPXML

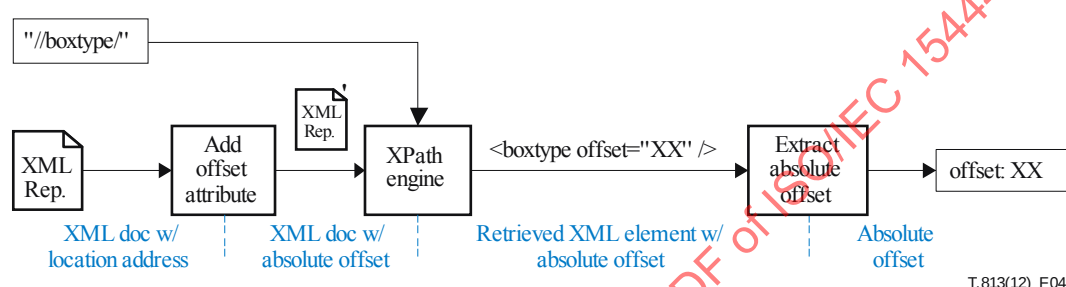


Figure 4 – Example of the process for converting between the XML location path and offset

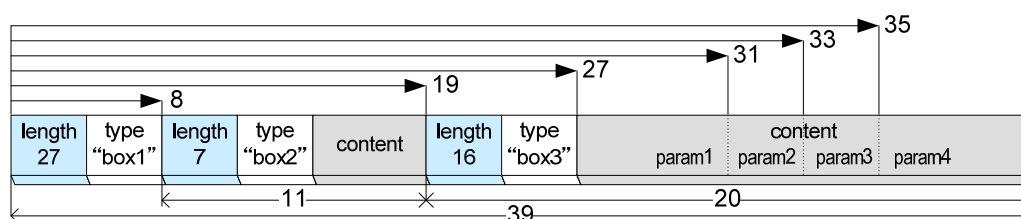
6.3 Access with the JPXML document

The two location representations, an XML location path and an absolute offset, are used to access internal image data with the JPXML document. The XML location path homologizes the target image data to identify the target element in the JPXML document. The absolute offset corresponding to the target element identified by the location path is used for locating the data chunk of the image, and this value shall be used for a binary data access. For converting between the text location and the offset value, conversion rules defined in 8.1 are used.

An absolute offset can be generated from the target location path in several ways. One example of generating a target offset process consists of three steps: 1) set each element's data chunk offset to its element offset attribute, 2) identify a target element from a target location path by using XML tools, and 3) extract the target element offset attribute value as an absolute offset. Figure 4 depicts an example of this process. After this process, the generated absolute offset is the location of the target data chunk from the very start of an image.

A target location path can be generated from a target absolute offset by following three steps: 1) set each element's data chunk offset to its element offset attribute, 2) identify a target element by comparing the element's offset attribute and the target offset, and 3) create a location path from the selected target element. This process creates the location path which identifies the target absolute offset, and this text representation will not suffer from binary data changes in the image.

These processes have the same offset generator for the JPXML document, and these generators use conversion rules defined in 8.1. Figure 5 is an example of a JPXML document with offset calculated by this generator. As shown in this example, the "box2" box offset is eight bytes because each box has eight bytes of data space for the box length and type of storage, and the "box2" is the first child of "box1" box. By using this generated JPXML document, all image data chunks described by the JPXML elements can be accessed by the XML location path.



(a) An example of part of a pseudo box-based format structure

```

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.

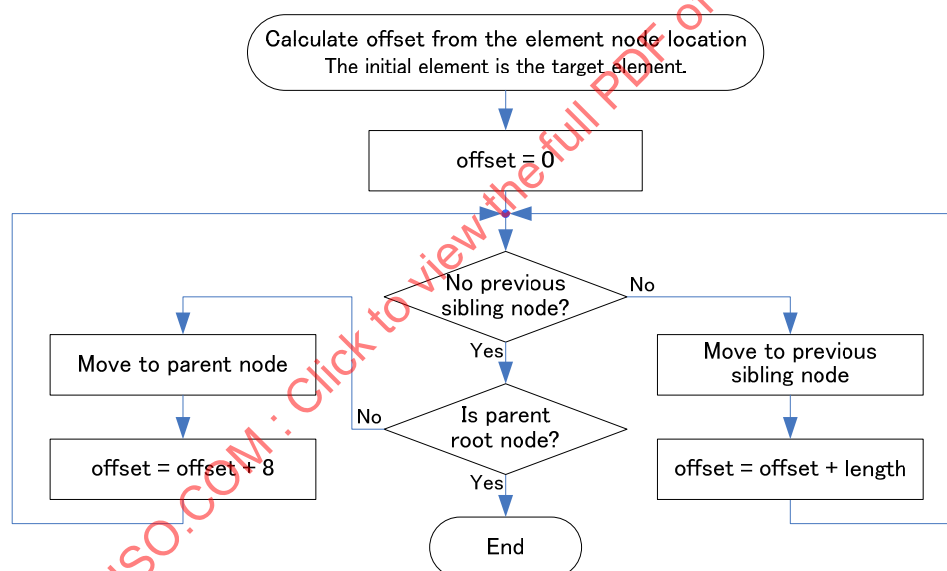


Figure 6 – Example 1 of an algorithm for calculating an offset value from the target element

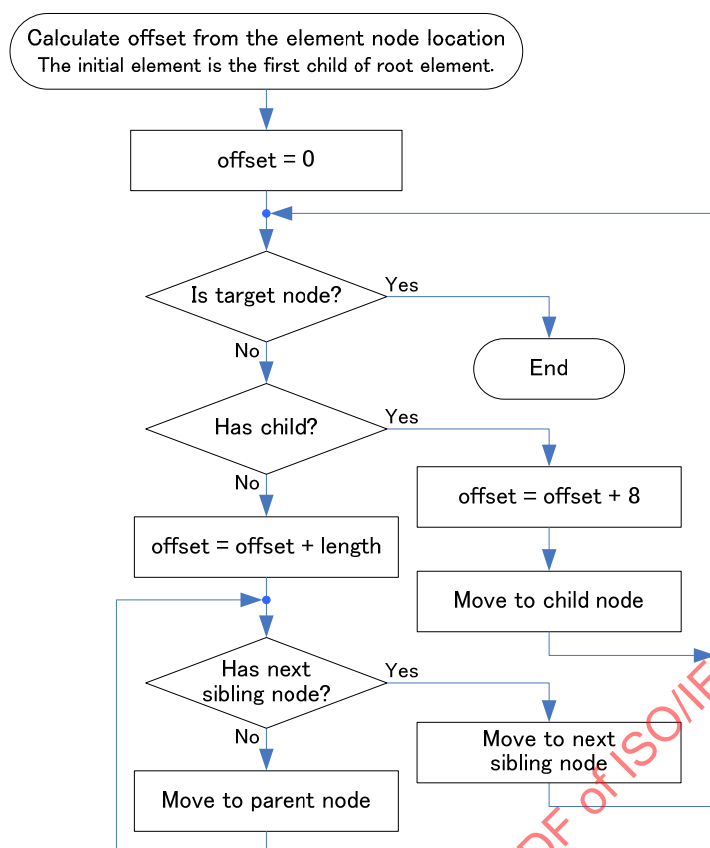


Figure 7 – Example 2 of an algorithm for calculating an offset value from the target element

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 JPXM 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
bpcc	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
bpcc	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	
eds_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	⌋	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
trf	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 'vide' 'soun' 'hint' '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 stsd

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
trex	–	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
cppt	optional	box	≥0

Table A.112 – Content element name for cppt

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	1

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	1

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	1

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
schl	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 fim

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_lobs	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
gppt	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 gppt

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

```

```

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

<xs:element name="sdat">
  <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="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="keyt" />
    </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="keyt" />
  </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="keyt" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:element name="keyt">
  <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 lenght"
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" />

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  <xs:element ref="volume" />
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      <xs:element ref="duration" />
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      <xs:sequence>
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        <xs:element ref="flag" />
        <xs:element ref="track id" />
        <xs:element ref="num entries" />
        <xs:element ref="delta offset" />
        <xs:element ref="first sample flags" />
        <xs:sequence minOccurs="0" maxOccurs="unbounded">
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          <xs:element ref="sample size" />
          <xs:element ref="sample flags" />
          <xs:element ref="sample time offset" />
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      </xs:sequence>
    </xs:complexType>
  </xs:element>

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        use="required" />

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        <xs:element ref="mfro" />
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  <xs:element name="tfra">
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        use="required" />

      <xs:sequence>
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        <xs:element ref="flag" />
        <xs:element ref="track id" />
        <xs:element ref="reserved" />
        <xs:element ref="traf index size" />
        <xs:element ref="trun index size" />
        <xs:element ref="sample index size" />
        <xs:element ref="num entries" />
        <xs:sequence maxOccurs="unbounded">
          <xs:element ref="time" />
          <xs:element ref="moof offset" />
          <xs:element ref="traf index" />
          <xs:element ref="trun index" />
          <xs:element ref="sample index" />
        </xs:sequence>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="sbgp">
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      <xs:sequence>
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        <xs:element ref="flag" />
        <xs:element ref="type" />
        <xs:element ref="num entries" />
        <xs:sequence maxOccurs="unbounded">
          <xs:element ref="sample count" />
          <xs:element
            ref="group_description_index" />
        </xs:sequence>
      </xs:sequence>
    </xs:complexType>
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        <xs:element ref="flag" />
        <xs:element ref="type" />
        <xs:element ref="default length" />
        <xs:element ref="num entries" />
        <xs:sequence maxOccurs="unbounded">
          <xs:element ref="description_length" />
          <xs:element ref="data" />
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      </xs:sequence>
    </xs:complexType>
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        <xs:element ref="language" />
        <xs:element ref="notice" />
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      <xs:element ref="flag" />
      <xs:element ref="switch group" />
      <xs:element ref="attributes" />
    </xs:sequence>
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      <xs:element ref="flag" />
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        <xs:element ref="xml" />
        <xs:element ref="bxml" />
      </xs:choice>
      <xs:sequence>
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        />
        <xs:element ref="pitm" minOccurs="0" />
        <xs:element ref="ipro" minOccurs="0" />
        <xs:element ref="iinf" minOccurs="0" />
        <xs:element ref="ipmc" minOccurs="0" />
        <xs:element ref="fiim" minOccurs="0" />
        <xs:element ref="hdlr" minOccurs="0" />
        <xs:element ref="dinf" minOccurs="0" />
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          <xs:element ref="length_size" />
          <xs:element ref="base_offset_size"
          />
          <xs:element ref="reserved" />
          <xs:element ref="num_entries" />
          <xs:sequence minOccurs="0" maxOccurs="unbounded">
            <xs:element ref="item_id" />
            <xs:element ref="data_reference"
            />
            <xs:element ref="base_offset" />
            <xs:element ref="sample_index" />

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      <xs:element ref="num_extents" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="extent_offset" />
        <xs:element ref="extent_length" />
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    </xs:sequence>
    <xs:element ref="item_id" />
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      <xs:element ref="version" />
      <xs:element ref="flag" />
      <xs:element ref="num_entries" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="sinf" />
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    </xs:sequence>
  </xs:complexType>
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      use="required" />
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      <xs:element ref="item_id" />
      <xs:element ref="item_protection_index" />
      <xs:element ref="item_name" />
      <xs:element ref="content_type" />
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        maxOccurs="unbounded" />
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      <xs:element ref="imif" minOccurs="0" />
      <xs:element ref="schm" minOccurs="0" />
      <xs:element ref="schi" minOccurs="0" />
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<xs:element name="frma">
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      <xs:element ref="data format" />
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      <xs:element ref="flag" />
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<xs:element name="ipmc">
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      <xs:element ref="flag" />
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      <xs:element ref="paen"
        minOccurs="0" maxOccurs="unbounded" />
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      <xs:element ref="reserved" />
      <xs:element ref="FEC_encoding_id" />

```

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    <xs:element ref="FEC instance id" />
    <xs:element ref="max source block length"
  />
  <xs:element ref="symbol length" />
  <xs:element ref="max_num_symbols" />
  <xs:element ref="scheme specific info" />
  <xs:element ref="num_entries" />
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      <xs:element ref="reserved" />
      <xs:element ref="data reference" />
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      <xs:element ref="compatible version" />
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        <xs:element ref="tsro"
          minOccurs="0" />
        <xs:element ref="snro"
          minOccurs="0" />
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      <xs:element ref="max_packet_size" />
      <xs:sequence maxOccurs="unbounded">
        <xs:element ref="tims" />
        <xs:element ref="srpp" />

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    <xs:element ref="tsro" minOccurs="0"
  />
    <xs:element ref="snro" minOccurs="0"
  />
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    <xs:sequence>
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    <xs:sequence>
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      <xs:element ref="flag" />
      <xs:element ref="encryption_rtp" />
      <xs:element ref="encryption_rtcp" />
      <xs:element ref="integrity_rtp" />
      <xs:element ref="integrity_rtcp" />
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      <xs:element ref="schi"
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    <xs:sequence>
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        <xs:element ref="sdp" />
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  </xs:complexType>
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  </xs:sequence>
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      <xs:element ref="tpyl" minOccurs="0" />
      <xs:element ref="totl" minOccurs="0" />
      <xs:element ref="npck" minOccurs="0" />
      <xs:element ref="tpay" minOccurs="0" />
      <xs:element ref="maxr" minOccurs="0"
        maxOccurs="unbounded" />
      <xs:element ref="dmed" minOccurs="0" />
      <xs:element ref="dimm" minOccurs="0" />
      <xs:element ref="drep" minOccurs="0" />
      <xs:element ref="tmin" minOccurs="0" />
      <xs:element ref="tmax" minOccurs="0" />
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    <xs:sequence>
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      use="required" />

    <xs:sequence>
      <xs:element ref="bytes sent" />
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      use="required" />

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

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</xs:element>

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      use="required" />

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

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      use="required" />

    <xs:sequence>
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    <xs:sequence>
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      use="required" />

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      use="required" />

    <xs:sequence>
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    </xs:sequence>
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      use="required" />

    <xs:sequence>
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    </xs:sequence>
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      use="required" />

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

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      use="required" />

    <xs:sequence>

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

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      <xs:element ref="count" />
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  </xs:complexType>
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      use="required" />

    <xs:sequence>
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      <xs:element ref="data reference" />
      <xs:element ref="track version" />
      <xs:element ref="compatible version" />
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      <xs:element ref="FEC overhead" />
    </xs:sequence>
  </xs:complexType>
</xs:element>

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      use="required" />

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        minOccurs="0" />
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      use="required" />

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      use="required" />

    <xs:sequence>
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<!-- part 12 content element -->

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      use="required" />

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

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    use="required" />
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<xs:element name="version" type="xs:integer">
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    use="required" />
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</xs:element>

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```

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</xs:element>

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

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

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

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

```

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</xs:element>

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    use="required" />
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    use="required" />
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<xs:element name="sample duration"
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```

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

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<xs:element name="base delta offset"
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    use="required" />
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<xs:element name="delta_offset"
  type="xs:integer">
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    use="required" />
</xs:element>

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  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="sample time offset"
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    use="required" />
</xs:element>

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

<xs:element name="trun index size"
  type="xs:integer">
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    use="required" />
</xs:element>

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

<xs:element name="moof offset"
  type="xs:integer">
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    use="required" />
</xs:element>

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</xs:element>

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

<xs:element name="base offset"
  type="xs:integer">
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    use="required" />
</xs:element>

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

<xs:element name="num_extents"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="extent offset"
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    use="required" />
</xs:element>

<xs:element name="extent_length"
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```

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    use="required" />
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<xs:element name="content encoding"
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    use="required" />
</xs:element>

<xs:element name="metabox relation"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="tool list" type="hexbyte">
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    use="required" />
</xs:element>

<xs:element name="metabox relation"
  type="hexbyte">
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    use="required" />
</xs:element>

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    use="required" />
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<xs:element name="schema_version"
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    use="required" />
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<xs:element name="schema location"
  type="xs:string">
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    use="required" />
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<xs:element name="packet_payload_size"
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    use="required" />
</xs:element>

<xs:element name="FEC_instance_id"
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    use="required" />
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<xs:element name="max source block length"
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</xs:element>

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<xs:element name="symbol length"
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    use="required" />
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<xs:element name="scheme specific info"
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    use="required" />
</xs:element>

<xs:element name="block count"
  type="xs:integer">
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<xs:element name="block_size"
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<xs:element name="num_group_ids"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="num_hint_track_ids"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="hint_track_id"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="group_id"
  type="xs:integer">
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    use="required" />
</xs:element>

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

<xs:element name="track version"
  type="xs:integer">
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    use="required" />
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    use="required" />
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<xs:element name="max_packet_size"
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    use="required" />
</xs:element>

<xs:element name="max_packet_size"
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  <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="encryption_rtp"
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    use="required" />
</xs:element>

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

<xs:element name="integrity_rtp"
  type="xs:integer">
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    use="required" />
</xs:element>

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

<xs:element name="format" type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="text" type="xs:string">
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    use="required" />
</xs:element>

<xs:element name="bytes_sent"
  type="xs:integer">
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    use="required" />
</xs:element>

<xs:element name="packets sent"
  type="xs:integer">
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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">
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    use="required" />
</xs:element>

<xs:element name="bytes_sent"
  type="xs:integer">
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    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
Delimiting markers and marker segments					
Start of codestream	SOC	0xFF4F	2	required ^a	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
Fixed information marker segments					
Image and tile size	SIz	0xFF51	43 to 49,192	required	not allowed
Functional marker segments					
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
Pointer marker segments					
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
In-bit-stream markers and marker segments					
Start of packet	SOP	0xFF91	6	not allowed	not allowed optional in-bitstream
End of packet header	EPH	0xFF92	2	optional inside PPM	optional inside PPT or in-bitstream
Informational marker segments					
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
Ztlim	1	integer	
Stlim	1	integer	
Ttlim	0 – 2	integer	□
Ptlim	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	
Psot	4	integer	
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
Crgn	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 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 (Non-normative Tool)	length	type	loop
IDraid	1+n	integer	
IDrans	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 (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 (Decryption Template)	length	type	loop
MEdecry	1+n	hexbyte	
CTdecry	2	hexbyte	
CPdecry	variable	hexbyte	

Tid (Authentication Temp.)	length	type	loop
MEauth	1+n	hexbyte	
Pauth	variable	hexbyte	

Tid (Hash Template)	length	type	loop
Hhash	1	hexbyte	
SIZhash	1	integer	

Table B.53 – Content element names for CPdecry

CPdecry (Block cipher)	length	type	loop
Mbc	3/4	hexbyte	
Pbc	1/4	hexbyte	
SIZbc	1	integer	
KTntid	variable	hexbyte	

CPdecry (Stream cipher)	length	type	loop
KTntid	variable	hexbyte	

CPdecry (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 (Hash-based Auth.)	length	type	loop
Mhmac	1	hexbyte	
Hhmac	1	hexbyte	
KTntid	variable	hexbyte	
SIZhmac	2	integer	

Pauth (Cipher-based Auth.)	length	type	loop
CACmac	1	hexbyte	
Ccmac	1	hexbyte	
KTntid	variable	hexbyte	
SIZcmac	2	integer	

Pauth (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"
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      <xs:element ref="CSpoc" />
      <xs:element ref="LYEoc" />
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      <xs:element ref="CEpoc" />
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