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Information technology — JPEG 2000 image coding system —

Part 12: ISO base media file format

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

Partie 12: Format ISO de base pour les fichiers médias

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15444-12 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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This third edition cancels and replaces the second edition (ISO/IEC 15444-12:2005) of which it constitutes a minor revision.

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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*

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Introduction

The ISO Base Media File Format is designed to contain timed media information for a presentation in a flexible, extensible format that facilitates interchange, management, editing, and presentation of the media. This presentation may be 'local' to the system containing the presentation, or may be via a network or other stream delivery mechanism.

The file structure is object-oriented; a file can be decomposed into constituent objects very simply, and the structure of the objects inferred directly from their type.

The file format is designed to be independent of any particular network protocol while enabling efficient support for them in general.

The ISO Base Media File Format is a base format for media file formats.

It is intended that the ISO Base Media File Format shall be jointly maintained by WG1 and WG11. Consequently, a subdivision of work created ISO/IEC 15444-12 and ISO/IEC 14496-12 in order to document the ISO Base Media File Format and to facilitate the joint maintenance.

This technically identical text is published as ISO/IEC 14496-12 for MPEG-4, and as ISO/IEC 15444-12 for JPEG 2000, and reference to this specification should be made accordingly. The recommendation is to reference one, for example ISO/IEC 14496-12, and append to the reference a parenthetical comment identifying the other, for example "(technically identical to ISO/IEC 15444-12)".

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Information technology — JPEG 2000 image coding system —

Part 12:
ISO base media file format

1 Scope

This part of ISO/IEC 15444 specifies the ISO base media file format, which is a general format forming the basis for a number of other more specific file formats. This format contains the timing, structure, and media information for timed sequences of media data, such as audio/visual presentations.

This part of ISO/IEC 15444 is applicable to JPEG 2000, but its technical content is identical to that of ISO/IEC 14496-12, which is applicable to MPEG-4.

2 Normative references

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The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO 639-2:1998, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ITU-T Rec. X.667 (09/2004) | ISO/IEC 9834-8:2005, *Information technology — Open Systems Interconnection — Procedures for the operation of OSI Registration Authorities: Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 Object Identifier components*

ISO/IEC 11578:1996, *Information technology — Open Systems Interconnection — Remote Procedure Call (RPC)*

ISO/IEC 14496-1:2004: *Information technology — Coding of audio-visual objects — Part 1: Systems*

ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Part 10: Advanced Video Coding*

ISO/IEC 14496-14, *Information technology — Coding of audio-visual objects — Part 14: MP4 file format*

ITU-T Rec.T.800 | ISO/IEC 15444-1, *Information technology — JPEG 2000 image coding system: Core coding system*

ITU-T Rec.T.802 | ISO/IEC 15444-3, *Information technology — JPEG 2000 image coding system: Motion JPEG 2000*

ISO/IEC 15938-1, *Information technology — Multimedia content description interface — Part 1: Systems*

ISO/IEC 23001-1, *Information technology — MPEG systems technologies — Part 1: Binary MPEG format for XML*

IETF RFC 3711, *"The Secure Real-time Transport Protocol (SRTP)"*, BAUGHER, M. et al., March 2004

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SMIL 1.0 *"Synchronized Multimedia Integration Language (SMIL) 1.0 Specification"*, <http://www.w3.org/TR/REC-smil/>

IETF RFC 2045, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies,* FREED, N. and BORENSTEIN, N., November 1996

IETF RFC 2046, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types,* FREED, N. and BORENSTEIN, N., November 1996

ITU-R Rec. TF.460-6, *Standard-frequency and time-signal emissions (Annex I for the definition of UTC.)*

3 Definitions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
box
object-oriented building block defined by a unique type identifier and length

NOTE Called 'atom' in some specifications, including the first definition of MP4.

3.1.2
chunk
contiguous set of samples for one track

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3.1.3
container box
box whose sole purpose is to contain and group a set of related boxes

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3.1.4
hint track
special track which does not contain media data, but instead contains instructions for packaging one or more tracks into a streaming channel

3.1.5
hinter
tool that is run on a file containing only media, to add one or more hint tracks to the file and so facilitate streaming

3.1.6
movie box
container box whose sub-boxes define the metadata for a presentation (`'moov'`)

3.1.7
media data box
box which can hold the actual media data for a presentation (`'mdat'`)

3.1.8
ISO Base Media File
name of the files conforming to the file format described in this specification

3.1.9
presentation
one or more motion sequences, possibly combined with audio

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3.1.10
sample
all the data associated with a single timestamp

NOTE 1 No two samples within a track can share the same time-stamp.

NOTE 2 In non-hint tracks, a sample is, for example, an individual frame of video, a series of video frames in decoding order, or a compressed section of audio in decoding order; in hint tracks, a sample defines the formation of one or more streaming packets).

3.1.11
sample description
structure which defines and describes the format of some number of samples in a track

3.1.12
sample table
packed directory for the timing and physical layout of the samples in a track

3.1.13
track
timed sequence of related samples (q.v.) in an ISO base media file

NOTE For media data, a track corresponds to a sequence of images or sampled audio; for hint tracks, a track corresponds to a streaming channel.

3.2 Abbreviated terms

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For the purposes of this International Standard, the following abbreviated terms apply.

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ALC Asynchronous Layered Coding
FD File Delivery
FDT File Delivery Table
FEC Forward Error Correction
FLUTE File Delivery over Unidirectional Transport
IANA Internet Assigned Numbers Authority
LCT Layered Coding Transport
MBMS Multimedia Broadcast/Multicast Service

4 Object-structured File Organization

4.1 File Structure

Files are formed as a series of objects, called boxes in this specification. All data is contained in boxes; there is no other data within the file. This includes any initial signature required by the specific file format.

All object-structured files conformant to this section of this specification (all Object-Structured files) shall contain a File Type Box.

4.2 Object Structure

An object in this terminology is a box.

Boxes start with a header which gives both size and type. The header permits compact or extended size (32 or 64 bits) and compact or extended types (32 bits or full Universal Unique IDentifiers, i.e. UUIDs). The

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standard boxes all use compact types (32-bit) and most boxes will use the compact (32-bit) size. Typically only the Media Data Box(es) need the 64-bit size.

The size is the entire size of the box, including the size and type header, fields, and all contained boxes. This facilitates general parsing of the file.

The definitions of boxes are given in the syntax description language (SDL) defined in MPEG-4 (see reference in clause 2). Comments in the code fragments in this specification indicate informative material.

The fields in the objects are stored with the most significant byte first, commonly known as network byte order or big-endian format. When fields smaller than a byte are defined, or fields span a byte boundary, the bits are assigned from the most significant bits in each byte to the least significant. For example, a field of two bits followed by a field of six bits has the two bits in the high order bits of the byte.

```
aligned(8) class Box (unsigned int(32) boxtype,
         optional unsigned int(8)[16] extended_type) {
   unsigned int(32) size;
   unsigned int(32) type = boxtype;
   if (size==1) {
      unsigned int(64) largesize;
   } else if (size==0) {
      // box extends to end of file
   }
   if (boxtype==‘uuid’) {
      unsigned int(8)[16] usertype = extended_type;
   }
}
```

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The semantics of these two fields are:

`size` is an integer that specifies the number of bytes in this box, including all its fields and contained boxes; if size is 1 then the actual size is in the field `largesize`; if size is 0, then this box is the last one in the file, and its contents extend to the end of the file (normally only used for a Media Data Box)

`type` identifies the box type; standard boxes use a compact type, which is normally four printable characters, to permit ease of identification, and is shown so in the boxes below. User extensions use an extended type; in this case, the type field is set to `‘uuid’`.

Boxes with an unrecognized type shall be ignored and skipped.

Many objects also contain a version number and flags field:

```
aligned(8) class FullBox(unsigned int(32) boxtype, unsigned int(8) v, bit(24) f)
   extends Box(boxtype) {
   unsigned int(8)   version = v;
   bit(24)           flags = f;
}
```

The semantics of these two fields are:

`version` is an integer that specifies the version of this format of the box.
`flags` is a map of flags

Boxes with an unrecognized version shall be ignored and skipped.

4.3 File Type Box

4.3.1 Definition

Box Type: ‘ftyp’
Container: File
Mandatory: Yes
Quantity: Exactly one

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Files written to this version of this specification must contain a file-type box. For compatibility with an earlier version of this specification, files may be conformant to this specification and not contain a file-type box. Files with no file-type box should be read as if they contained an FTYP box with `Major_brand='mp41'`, `minor_version=0`, and the single compatible brand `'mp41'`.

A media-file structured to this part of this specification may be compatible with more than one detailed specification, and it is therefore not always possible to speak of a single 'type' or 'brand' for the file. This means that the utility of the file name extension and Multipurpose Internet Mail Extension (MIME) type are somewhat reduced.

This box must be placed as early as possible in the file (e.g. after any obligatory signature, but before any significant variable-size boxes such as a Movie Box, Media Data Box, or Free Space). It identifies which specification is the 'best use' of the file, and a minor version of that specification; and also a set of other specifications to which the file complies. Readers implementing this format should attempt to read files that are marked as compatible with any of the specifications that the reader implements. Any incompatible change in a specification should therefore register a new 'brand' identifier to identify files conformant to the new specification.

The minor version is informative only. It does not appear for compatible-brands, and must not be used to determine the conformance of a file to a standard. It may allow more precise identification of the major specification, for inspection, debugging, or improved decoding.

Files would normally be externally identified (e.g. with a file extension or mime type) that identifies the 'best use' (major brand), or the brand that the author believes will provide the greatest compatibility.

This section of this specification does not define any brands. However, see subclause 6.3 below for brands for files conformant to the whole specification and not just this section. All file format brands defined in this specification are included in Annex E with a summary of which features they require.

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4.3.2 Syntax

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```
aligned(8) class FileTypeBox
   extends Box('ftyp') {
   unsigned int(32)  major_brand;
   unsigned int(32)  minor_version;
   unsigned int(32)  compatible_brands[];   // to end of the box
}
```

4.3.3 Semantics

This box identifies the specifications to which this file complies.

Each brand is a printable four-character code, registered with ISO, that identifies a precise specification.

`major_brand` – is a brand identifier
`minor_version` – is an informative integer for the minor version of the major brand
`compatible_brands` – is a list, to the end of the box, of brands

5 Design Considerations

5.1 Usage

5.1.1 Introduction

The file format is intended to serve as a basis for a number of operations. In these various roles, it may be used in different ways, and different aspects of the overall design exercised.

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5.1.2 Interchange

When used as an interchange format, the files would normally be self-contained (not referencing media in other files), contain only the media data actually used in the presentation, and not contain any information related to streaming. This will result in a small, protocol-independent, self-contained file, which contains the core media data and the information needed to operate on it.

The following diagram gives an example of a simple interchange file, containing two streams.

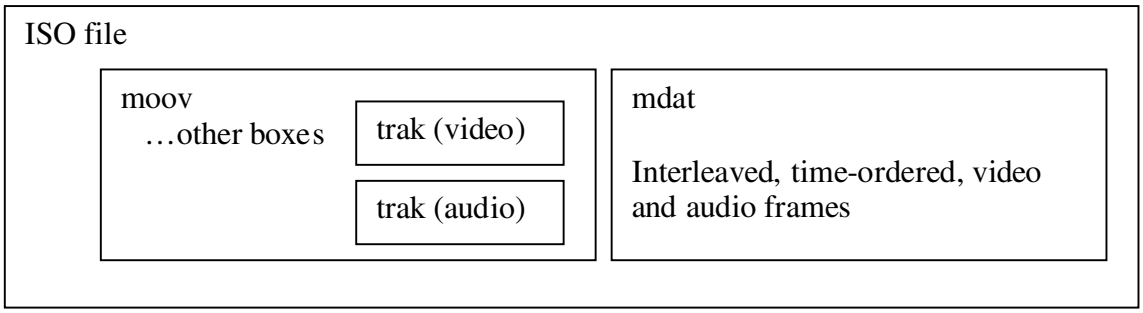

Figure 1 — Simple interchange file

5.1.3 Content Creation

During content creation, a number of areas of the format can be exercised to useful effect, particularly:

- the ability to store each elementary stream separately (not interleaved), possibly in separate files.
- the ability to work in a single presentation that contains media data and other streams (e.g. editing the audio track in the uncompressed format, to align with an already-prepared video track).

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These characteristics mean that presentations may be prepared, edits applied, and content developed and integrated without either iteratively re-writing the presentation on disc – which would be necessary if interleave was required and unused data had to be deleted, and also without iteratively decoding and re-encoding the data – which would be necessary if the data must be stored in an encoded state.

In the following diagram, a set of files being used in the process of content creation is shown.

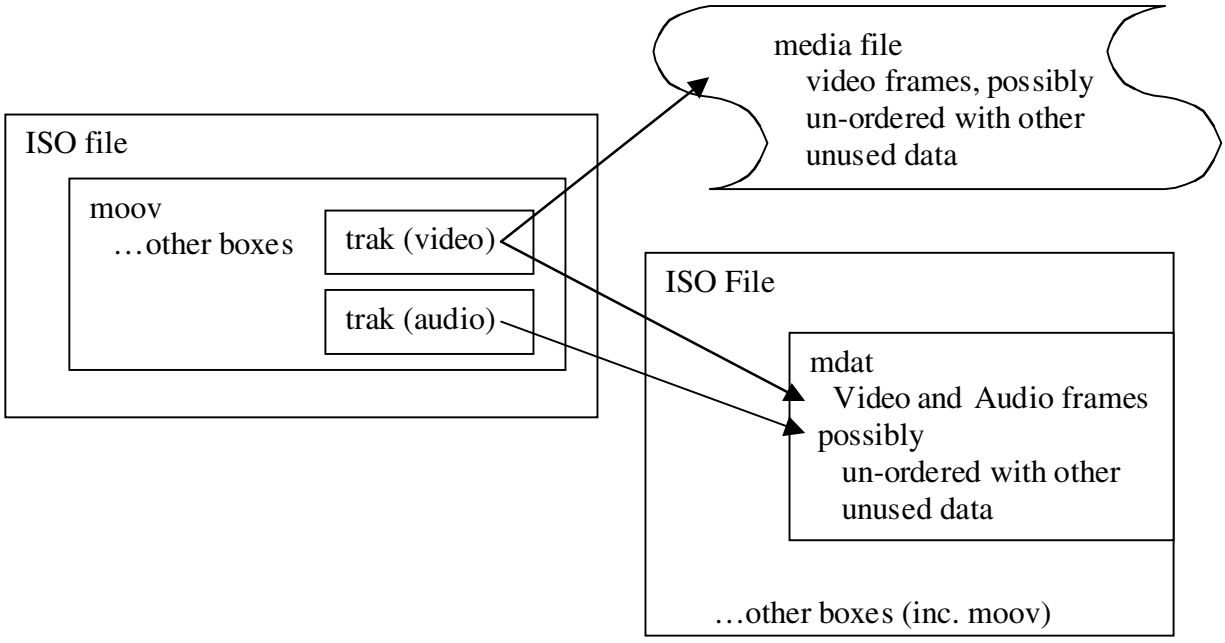

Figure 2 — Content Creation File

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5.1.4 Preparation for streaming

When prepared for streaming, the file must contain information to direct the streaming server in the process of sending the information. In addition, it is helpful if these instructions and the media data are interleaved so that excessive seeking can be avoided when serving the presentation. It is also important that the original media data be retained unscathed, so that the files may be verified, or re-edited or otherwise re-used. Finally, it is helpful if a single file can be prepared for more than one protocol, so differing servers may use it over disparate protocols.

5.1.5 Local presentation

'Locally' viewing a presentation (i.e. directly from the file, not over a streamed interconnect) is an important application; it is used when a presentation is distributed (e.g. on CD or DVD ROM), during the process of development, and when verifying the content on streaming servers. Such local viewing must be supported, with full random access. If the presentation is on CD or DVD ROM, interleave is important as seeking may be slow.

5.1.6 Streamed presentation

When a server operates from the file to make a stream, the resulting stream must be conformant with the specifications for the protocol(s) used, and should contain no trace of the file-format information in the file itself. The server needs to be able to random access the presentation. It can be useful to re-use server content (e.g. to make excerpts) by referencing the same media data from multiple presentations; it can also assist streaming if the media data can be on read-only media (e.g. CD) and not copied, merely augmented, when prepared for streaming.

iTeh STANDARD PREVIEW

The following diagram shows a presentation prepared for streaming over a multiplexing protocol, only one hint track is required.

(standards.iteh.ai)
ISO/IEC 15444-12:2008
https://standards.iteh.ai/catalog/standards/sist/7036305b-2a0a-4c8c-a153-b8beec15c624/iso-iec-15444-12-2008

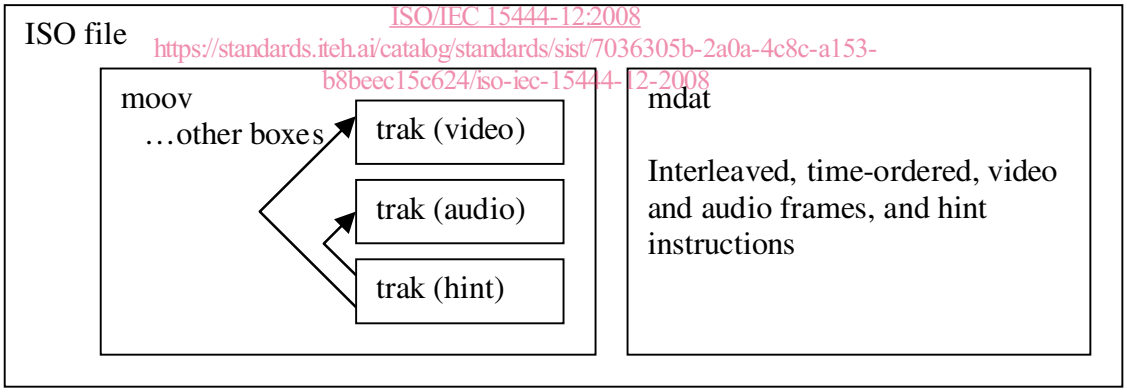

Figure 3 — Hinted Presentation for Streaming

5.2 Design principles

The file structure is object-oriented; a file can be decomposed into constituent objects very simply, and the structure of the objects inferred directly from their type.

Media-data is not 'framed' by the file format; the file format declarations that give the size, type and position of media data units are not physically contiguous with the media data. This makes it possible to subset the media-data, and to use it in its natural state, without requiring it to be copied to make space for framing. The metadata is used to describe the media data by reference, not by inclusion.

Similarly the protocol information for a particular streaming protocol does not frame the media data; the protocol headers are not physically contiguous with the media data. Instead, the media data can be included by reference. This makes it possible to represent media data in its natural state, not favouring any protocol. It also makes it possible for the same set of media data to serve for local presentation, and for multiple protocols.

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