
**Information technology — Multimedia
application format (MPEG-A) —**

**Part 22:
Multi-image application format (MIAF)**

*Technologies de l'information — Format pour application multimédia
(MPEG-A) —*

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Partie 22: Format pour application à images multiples (MIAF)

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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

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

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

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

A list of all parts in the ISO/IEC 23000 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies a multimedia application format, the Multi-Image Application Format (MIAF), that enables precise interoperability points for creation, reading, parsing and decoding of images embedded in the High Efficiency Image File (HEIF) format. The MIAF specification fully conforms to the HEIF format and only defines additional constraints to ensure higher interoperability.

The HEIF specification (ISO/IEC 23008-12) defines a file format for the inclusion of one or more images, possibly with one or more sequences of images, with associated metadata and their relationship to each other. While the HEIF specification defines the file format and general requirements for the included coding formats, it does not define specific interoperability points by which capturing devices, editing applications, storage systems, cloud and delivery networks, and playback devices and applications can interoperate with each other.

This document, by defining specific constraints on the HEIF format, limiting the supported encoding types to a set of specific profiles and levels, requiring specific metadata formats, and defining a set of brands for signalling such constraints, defines precise interoperability points which enable the industry to deploy particular uses of the HEIF specification to improve interoperability.

This document defines the normative requirements for MIAF files as well as for MIAF readers and renderers.

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Information technology — Multimedia application format (MPEG-A) —

Part 22: Multi-image application format (MIAF)

1 Scope

This document specifies the Multi-Image Application Format (MIAF), which contains coded images, groups and sequences of images along with their metadata and the information about their relations to each other, all embedded in the High Efficiency Image File (HEIF) format.

This document builds on the HEIF specification and defines the following:

- a set of additional constraints on ISO/IEC 23008-12 (HEIF) specification, to simplify its file format options;
- specific alpha plane formats;
- a set of specific profiles and levels for the supported coding formats;
- a set of specific metadata formats;
- a set of brands, including application brands indicating conformance with specific profiles;
- a set of rules for extending MIAF format to support additional coding formats, profiles, levels and metadata.

This document also defines the normative behaviour for a MIAF reader and MIAF renderer.

The MIAF specification is intentionally written to be extensible, and to allow for forward compatibility. The format is also permissive of the presence of other data, such as coding formats, metadata, and derived images.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 14496-3, *Information technology — Coding of audio-visual objects — Part 3: Audio*

Rec. ITU-T H.264 | ISO/IEC 14496-10, *Information technology — Coding of audio-visual objects — Advanced video coding*

ISO/IEC 14496-12, *Information technology — Coding of audio-visual objects — Part 12: ISO base media file format*

ISO/IEC 14496-15, *Information technology — Coding of audio-visual objects — Part 15: Carriage of network abstraction layer (NAL) unit structured video in the ISO base media file format*

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

ISO 16684-1, *Graphic technology — Extensible metadata platform (XMP)— Part 1: Data model, serialization and core properties*

ISO/IEC 23000-19, *Information technology — Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media*

ISO/IEC 23001-14, *Information technology — MPEG systems technologies — Part 14: Partial file format*

Rec. ITU-T H.265 | ISO/IEC 23008-2, *Information technology — High efficiency coding and media delivery in heterogeneous environments — High efficiency video coding*

ISO/IEC 23008-12, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 12: Image File Format*

JEITA CP-3451, Exchangeable image file format for digital still cameras

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Rec. ITU-T H.264 | ISO ISO/IEC 14496-10, Rec. ITU-T H.264 | ISO ISO/IEC 23008-2, ISO/IEC 14496-12, ISO/IEC 23008-12 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

3.1 alpha plane

image specifying the transparency information of the master image

Note 1 to entry: When the resolution of an alpha plane differs from that of the master image, MIAF renderers are expected to rescale the alpha plane to the resolution of the master image, but the rescaling operation is not specified exactly and thus the exact behaviour of different MIAF renderer implementations can differ.

3.2 depth map

image that contains information relating to the distance of the surfaces of scene objects from a viewpoint

3.3 MIAF application brand

brand indicating that a *MIAF file* (3.5) conforms to a specific *MIAF profile* (3.8) and that *MIAF readers* (3.9) and *MIAF renderers* (3.12) that only implement the features required by that MIAF profile can process the MIAF file

3.4 MIAF auxiliary image item

image item that provides auxiliary visual information but is not normally independently rendered

Note 1 to entry: The requirements are in subclause 7.3.5.

3.5 MIAF file

file containing one or more image and/or image sequence and/or video tracks

Note 1 to entry: A MIAF file is constrained to conform to [clause 7](#).

3.6 MIAF master image item

image item that may be rendered

3.7**MIAF image item**

MIAF master image item (3.6), *MIAF auxiliary image item* (3.4) or *MIAF thumbnail image item* (3.10)

3.8**MIAF profile**

set of restrictions on a *MIAF file* (3.5)

Note 1 to entry: These are typically restrictions on the media coding format/profile/level, content protection scheme, or on quantitative measures. MIAF profiles enable interoperability between MIAF files and MIAF readers.

Note 2 to entry: A MIAF file may conform to multiple MIAF profiles. A MIAF reader or MIAF renderer may be capable of processing one or more MIAF profiles.

3.9**MIAF reader**

entity that reads and parses *MIAF files* (3.5), identifies the type of image coding and metadata, and decodes the coded streams for the coding types/profiles/levels that it supports

3.10**MIAF thumbnail image item**

image item that is referenced using the thumbnail reference type

Note 1 to entry: The requirements for a MIAF thumbnail image item are specified in subclause 7.3.3.

3.11**MIAF player**

entity including a *MIAF reader* (3.9) and a *MIAF renderer* (3.12)

3.12**MIAF renderer**

entity that renders the output of *MIAF reader* (3.9) into a *visual context* (3.15), taking into account associated metadata (e.g. colour information) and auxiliary image data (e.g. alpha planes)

3.13**primary image**

image identified as the *primary item* (3.14) in the file-level `MetaBox`

3.14**primary item**

item as identified by the `PrimaryItemBox` in the file-level `MetaBox`

3.15**visual context**

visual rendering surface such as a screen buffer, which may already contain visual material, and onto which an image can be rendered

4 Abbreviations

AVC	Advanced Video Coding (as specified by Rec. ITU-T H.264 ISO/IEC 14496-10)
HEIF	High Efficiency Image File format (as specified by ISO/IEC 23008-12)
HEVC	High Efficiency Video Coding (as specified by Rec. ITU-T H.265 ISO/IEC 23008-2)
MIAF	Multi Image Application Format (as specified by this document)

5 Document organization and conventions

[Clause 6](#) specifies general concepts and processing of MIAF files.

[Clause 7](#) specifies general requirements that apply to all profiles. These requirements are split in two ways:

- requirements at the file format structure level, and requirements at the 'abstraction layer' that the file format structures create; and
- requirements for both still images, image sequences and video.

[Clause 8](#) specifies constraints which are shared by one or more profiles.

[Clause 9](#) specifies the coding format(s) that are required to be supported in any player, independent of any profile.

[Clause 10](#) specifies the brands that indicate conformance to the normative requirements of this document, common to all profiles (as documented in the clauses preceding the annexes), and the applicable file extensions.

[Annex A](#) specifies the profiles, each of which imposes a set of specific restrictions which shall be followed for enabling interoperability between MIAF files and MIAF readers.

This document derives variables that are named by a mixture of lower case and upper case letters and without any underscore characters. Variables starting with an upper case letter are derived for the current syntax structure and all depending syntax structures. Variables starting with an upper case letter may be used in the specification for dependent syntax structures without mentioning the originating syntax structure of the variable. Variables starting with a lower case letter are only used within the clause in which they are derived.

6 MIAF concepts and processing of MIAF files

6.1 General

This clause describes the overall encoding, packaging, parsing and decoding architecture as well as the data structure (concepts of image, image sequence, video, metadata, etc.).

This document places requirements on

- the format of files;
- the action of a process that reads and parses a file, and produces output images (a "reader");
- the action of a process that renders the output images (a "renderer").

[Figure 1](#) illustrates a possible processing model to handle MIAF files. A MIAF reader gets a MIAF file as input. In addition, the caller process or application provides inputs on how the file is intended to be processed. The MIAF reader produces output images that are provided to the MIAF renderer for displaying. The rendering takes place on a visual context, such as a screen buffer, and is controlled by the caller process or application.

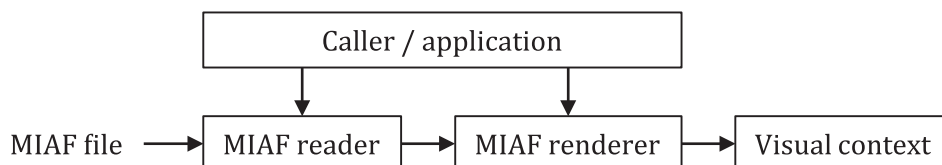


Figure 1 — Processing of a MIAF file

6.2 MIAF data object model

The data object model consists of the boxes at the file format layer, and the two abstraction layers that those boxes create:

- image items, with their properties, and relationships (expressed by item references);
- image sequences and/or video, with the sample entry setup information, and their relationships (expressed by track references).

These two abstraction layer models can be linked by references and entity groups.

Image items are suitable when neither timing nor coding dependency is required. If either timing is required or the coding scheme takes advantage of inter-picture prediction, an image sequence track or a video track is used. A key difference between image sequence tracks and video tracks is that, in image sequence tracks, the timing is advisory. Consequently, it is suggested that MIAF files contain image sequence tracks when timing is not meaningful or essential for playback — for example, images captured with exposure or focal bracketing.

6.3 MIAF image items

A MIAF image item is an item that conforms

- a) to the box-level requirements for items in subclause [7.2.1](#);
- b) to the requirements for items in subclause [7.3](#);
- c) to the requirements of a defined MIAF codec profile;
- d) and for which a MIAF brand appears in the `FileTypeBox`.

6.4 MIAF thumbnail image items

A MIAF thumbnail image item is an item that

- a) is referenced as a thumbnail image from a MIAF master image item;
- b) conforms to the box-level requirements for items in subclause [7.2](#);
- c) conforms also to the requirements for items in subclause [7.3](#);
- d) conforms either to a profile that a MIAF reader conforming to the profile of the associated master image item is required to support, or to the requirements of a format defined in [clause 9](#);
- e) is unprotected;
- f) has its image data stored in the same file as the MIAF master image item for which it is a thumbnail.

6.5 MIAF auxiliary image item

A MIAF auxiliary image item is an item that

- a) conforms to the box-level requirements for items in subclause [7.2](#);
- b) conforms also to the requirements for items in subclause [7.3](#);
- c) conforms to the requirements for auxiliary items in subclause [7.3.5](#);
- d) conforms either to the requirements of the same MIAF codec profile as the MIAF master image item for which it is an auxiliary image, or to the requirements of a format defined in [clause 9](#).

A MIAF auxiliary image may have alternates.

6.6 MIAF reader processing model

A MIAF reader is an entity capable of:

- a) concluding which image item(s) or track(s) of a MIAF-conforming file are to be output based on given input parameters;
- b) decoding image items(s) or track(s) to be output;
- c) generating the output pictures from the decoded pictures (e.g. by applying transformative image properties); and
- d) outputting the output pictures and file metadata associated with the output pictures.

Inputs to a MIAF reader are:

- a file with a `FileTypeBox` containing at least one brand specified in this document;
- optionally one of the following:
 - `item_ID` of the item to be output (`psItemId`),
 - `track_ID` of the track to be output (`psTrackId`),
 - a selection between a static image (`psImagePreferredFlag` equal to 1) or track (`psImagePreferredFlag` equal to 0) to be output,

NOTE 1 When neither `psItemId` nor `psTrackId` is provided as input, a default image item or track is selected as specified in this clause.

- optionally constraints, such as the maximum width and height of an image item or track;
- optionally one or more of the following roles of the image or track to be output:
 - master (default),
 - thumbnail,
 - auxiliary, which may be further classified by the type.

NOTE 2 More than one role can be provided as input for example to instruct a MIAF reader to return both an image item and its alpha plane (when present).

Outputs of a MIAF reader are:

- the output image(s) of the track(s) or item(s) that was (were) requested as input or selected by the MIAF reader as specified below, not including any non-output samples as defined in ISO/IEC 14496-12;
- in the case that any tracks are present, the composition times for each output sample, with any associated edit list;
- the metadata associated with the output image(s), including the content of the `ColourInformationProperty` OR `ColourInformationBox`.

NOTE 3 When a MIAF reader is requested to provide auxiliary images as output, the output image(s) of the MIAF reader include output images of auxiliary image item(s) or decoded samples of auxiliary track(s) of any type, when no input of auxiliary picture type is given to the MIAF reader, or of the type matching that given as input to the MIAF reader.