
**Information technology — Multimedia
content description interface —**

**Part 6:
Reference software**

*Technologies de l'information — Interface de description du contenu
multimédia —*

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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*.

This second edition cancels and replaces the first edition (ISO/IEC 15938-6:2003), which has been technically revised. It also incorporates the Amendments ISO/IEC 15938-6:2003/Amd.1:2006, ISO/IEC 15938-6:2003/Amd.1:2006/Cor.1:2007, ISO/IEC 15938-6:2003/Amd.2:2007, ISO/IEC 15938-6:2003/Amd.3:2010 and ISO/IEC 15938-6:2003/Amd.4:2011. The main changes compared to the previous edition are as follows:

- all previous Amendments have been incorporated and the electronic attachments have been updated;
- minor editorial corrections have been made throughout the document to fully align with ISO/IEC Directives.

A list of all parts in the ISO/IEC 15938 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 provides a standardized set of technologies for describing multimedia content. It addresses a broad spectrum of multimedia applications and requirements by providing a metadata system for describing the features of multimedia content.

The software is available at: <https://standards.iso.org/iso-iec/15938/-6/ed-2/en>.

The following are specified in this document:

Description schemes (DS) describe entities or relationships pertaining to multimedia content. Description schemes specify the structure and semantics of their components, which can be description schemes, descriptors, or datatypes.

Descriptors (D) describe features, attributes, or groups of attributes of multimedia content.

Datatypes are the basic reusable datatypes employed by description schemes and descriptors.

Systems tools support delivery of descriptions, multiplexing of descriptions with multimedia content, synchronization, file format, and so forth.

This document contains simulation software for tools defined in ISO/IEC 15938-1, ISO/IEC 15938-2, ISO/IEC 15938-3, ISO/IEC 15938-4 and ISO/IEC 15938-5. This software has been derived from the verification models used in the process of developing this series.

Where multimedia content extraction or multimedia content description software is provided, attention is called to the fact that these software modules are provided for the purpose of creating bitstreams of descriptors and description schemes with normative syntax. The performance of these software tools is not indicative of that which can be obtained from implementations where quality and computational optimization are given priority. The techniques used for extracting descriptors or deriving description schemes are not specified by this document. This information can be found in the corresponding Part of the ISO/IEC 15938 series.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

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Information technology — Multimedia content description interface —

Part 6: Reference software

1 Scope

The ISO/IEC 15938 series operates on and generates conformant bitstreams. This document provides a specific implementation that behaves in a conformant manner.

NOTE 1 Other implementations that conform to the ISO/IEC 15938 series are possible, which do not necessarily use the algorithms or the programming techniques of the reference software.

The software contained in this document is known as eXperimentation Model (XM) and is divided into five categories:

- a) Binary format for MPEG-7 (BiM). This software converts DDL (XML) based descriptions to binary format and vice versa as explained in [Clause 5](#).
- b) DDL parser and DDL validation parser. The components of this software module are specified in [Clause 6](#).
- c) Visual descriptors. This software creates standard visual descriptions from associated (visual) media content as explained in [Clause 7](#).

NOTE 2 The techniques used for extracting descriptors are informative, and the quality and complexity of these extraction tools has not been optimized.

- d) Audio descriptors. This software creates standard descriptions from associated (audio) media content as explained in [Clause 8](#).

NOTE 3 The techniques used for extracting descriptors are informative, and the quality and complexity of these extraction tools has not been optimized.

- e) Multimedia description schemes. This software modules provide standard descriptions of multimedia description schemes as specified in [Clause 9](#).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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/>

4 Abbreviated terms

AV	audio-visual
CS	coding scheme
D	descriptor
Ds	descriptors
DCT	discrete cosine transform
DDL	description definition language
DS	description scheme
DSs	description schemes
MDS	multimedia description schemes
MPEG	moving picture experts group
MPEG-7	multimedia content description interface standard (the ISO/IEC 15938 series)
XML	eXtensible Markup Language

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5 Copyright disclaimer for software modules

The source code for this document can be found at <https://standards.iso.org/iso-iec/15938/-6/ed-2/en/>.

Each source code module in this document contains a copyright disclaimer which shall not be removed from the source code module.

In the text of each copyright disclaimer, <MPEG standard> is replaced with a reference to its associated specification, e.g. MPEG-7 Systems (ISO/IEC 15938-1), MPEG-7 Visual (ISO/IEC 15938-3), MPEG-7 Audio (ISO/IEC 15938-4), MPEG-7 Multimedia description schemes (ISO/IEC 15938-5).

"This software module was originally developed by <FN1> <LN1> (<CN1>) and edited by <FN2> <LN2> (<CN2>), <FN3> <LN3> (<CN3>), in the course of development of the <MPEG standard>. This software module is an implementation of a part of one or more <MPEG standard> tools as specified by the <MPEG standard>. ISO/IEC gives users of the <MPEG standard> free license to this software module or modifications thereof for use in hardware or software products claiming conformance to the <MPEG standard>. Those intending to use this software module in hardware or software products are advised that its use may infringe existing patents. The original developer of this software module and his/her company, the subsequent editors and their companies, and ISO/IEC have no liability for use of this software module or modifications thereof in an implementation. Copyright is not released for non <MPEG standard> conforming products. <CN1> retains full right to use the code for his/her own purpose, assign or donate the code to a third party and to inhibit third parties from using the code for non <MPEG standard> conforming products. This copyright notice must be included in all copies or derivative works. Copyright ©20xx-20xx".

<FN>=First Name, <LN>=Last Name, <CN>=Company Name

6 XM software architecture

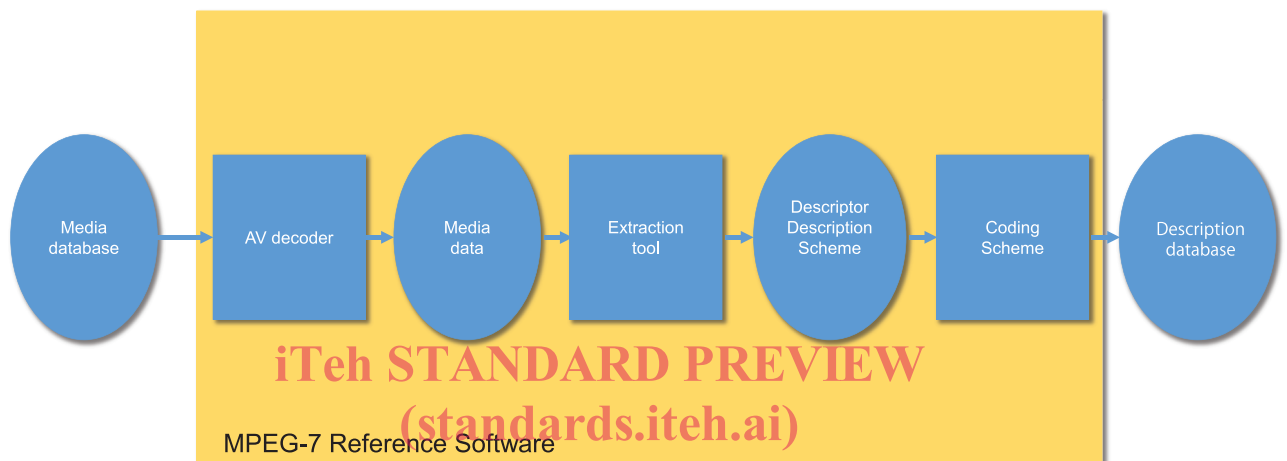
6.1 Block diagrams

This clause provides information about the XM software architecture. The block diagrams give short overviews and introduce individual components of the XM software.

The composing elements of the MPEG-7 reference software are characterized by their functionality and by their interfaces. They can be configured according to what here is referred as "key applications". From a functional point of view, they can be distinguished as follows:

- "extraction applications" (a description data base is built from a media database) as illustrated in [Figure 1](#);
- "search and retrieval applications" (a description is compared with the descriptions in a database to find the one with the lowest distance) as illustrated in [Figure 2](#);
- "transcoding applications" (a media data base is converted into another media database based on its description) as illustrated in [Figure 3](#).

EXTRACTION APPLICATION



ISO/IEC 15938-6:2020

Figure 1 — An "extraction application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures

SEARCH & RETRIEVAL APPLICATION

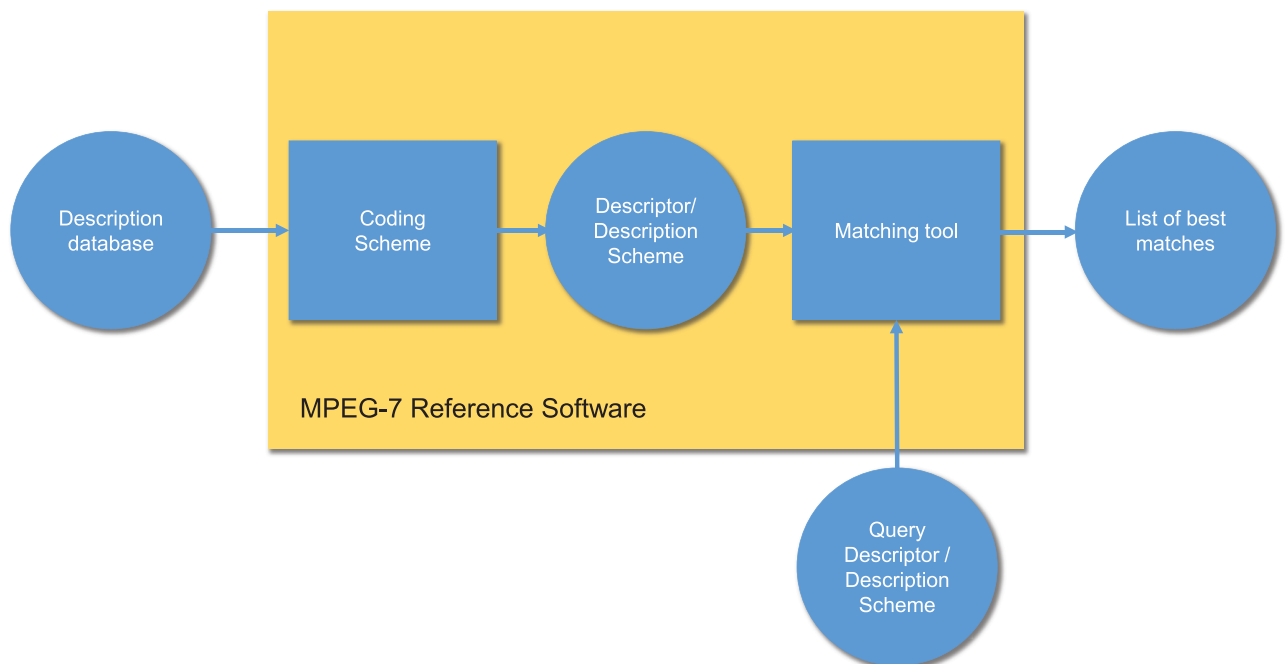


Figure 2 — A "search and retrieval application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures

TRANSCODING APPLICATION

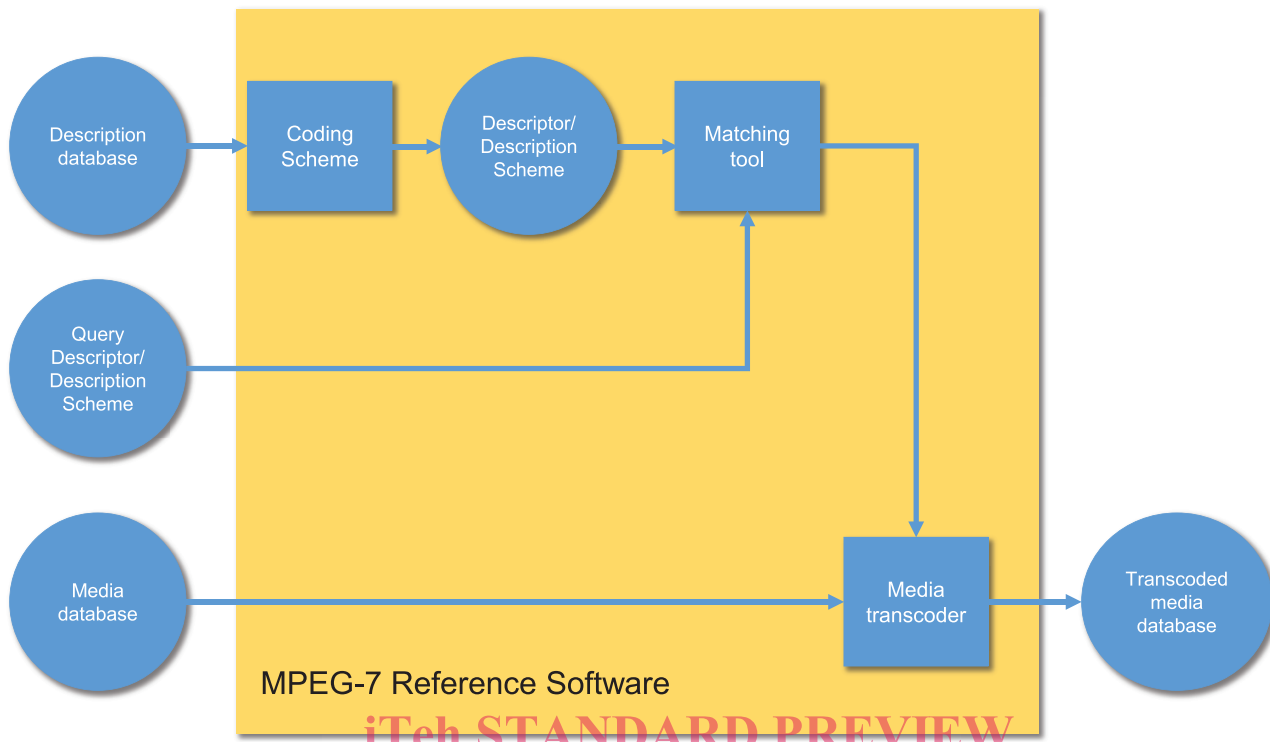


Figure 3 — A "transcoding application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures

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6.2 Block descriptions

6.2.1 General

In subclauses 6.2.2 through 6.2.11, the blocks of the "key applications" are distinguished. For elements that are related to specific descriptors or description schemes, the interface is given using a DummyType example. This represents the XM integration template and not a normative descriptor or description scheme.

6.2.2 Media database

The media database contains media files, which are supported as input files by the AV decoders. The database file is read from a file and contains one media filename per line. From this media filename all additional input and output filenames can be derived.

6.2.3 AV decoders

The XM supports the following AV decoders:

- Still image decoders: ImageMagick®¹⁾ (Ver. 6.8.8 linked as external library, not included in the XM reference software distribution).
- MPEG-1, MPEG-2 video decoders: (XM directory: Decoders/MPEG2Dec).

1) ImageMagick® is the trademark of a product supplied by ImageMagick Studio LLC. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

- MPEG-1 video motion vector extractor: (XM directory: Decoders/MPEG2Dec). This extracts images and motion vectors.
- 3D Objects: (XM directory: Media). This reads a 3D object for 3D shape descriptors.
- Key Points: (XM directory: Media). This reads in a list of key points from a file.
- Audio decoders: (XM directory: Media). They read audio files.

6.2.4 Media data

This is the internal XM representation of the raw media data (one class with different structures depending on the media content type). The class description for media data can be found in the Media XM directory.

6.2.5 Extraction tools

Extraction tools are specific extraction methods defined for each descriptor and description scheme. All the source files are available in the ExtractionUtilities XM directory. The extraction tools extract the descriptions from media data. Because media data can be of significant size, the extraction is performed on time entities of the media, i.e., if the media is a video the extraction is done frame by frame. Some of the extraction tools may need OpenCV linked with XM as an external library. The interface of the DummyType extraction tool (implementation template) is:

```
//=====
class DummyTypeExtractionTool: public DescriptorExtractor
{
    friend DummyTypeExtractionInterface;
public:
    // Null constructor
    DummyTypeExtractionTool();

    // Also connects the Descriptor (result memory) to the extraction
    // If set to "0" it automatically creates the descriptor
    DummyTypeExtractionTool(DummyTypeDescriptorInterfaceABC
        *DummyType);

    // ID of object type
    virtual const UUID& GetObjectID(void);
    // Object type name
    virtual const char *GetName(void);

    // This informs the extractor where the source data comes from
    virtual int SetSourceMedia(MultiMediaInterfaceABC* media);

    // Pointer where the description is stored
    virtual DummyTypeDescriptorInterfaceABC*
        GetDescriptorInterface(void);
    virtual int SetDescriptorInterface(DummyTypeDescriptorInterfaceABC
        *aDummyTypeDescriptorInterface);

    // initialize descriptor and extraction process (input media must be known)
    virtual unsigned long InitExtracting(void);

    // performs extraction from input media frame by input media frame
    virtual unsigned long StartExtracting(void);

    // collects descriptor data after all input media frames were processed
    virtual unsigned long PostExtracting(void);

    // Extraction object must not be used, only its interface is allowed
    // to be used. This function is to get the interface
    virtual DummyTypeExtractionInterfaceABC *GetInterface(void);

    // access is allowed only by class factories for this
    // object. This avoids having to duplicate the
    // ID definition in multiple locations. In the future, we may
```