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Part 6: Reference software

*Technologies de l'information — Interface de description du contenu multimédia —
Partie 6: Logiciel de référence*

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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 15938-6 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 of which has been technically revised.

ISO/IEC 15938 consists of the following parts, under the general title *Information technology — Multimedia content description interface*:

- *Part 1: Systems*
- *Part 2: Description definition language*
- *Part 3: Visual*
- *Part 4: Audio*
- *Part 5: Multimedia description schemes*
- *Part 6: Reference software*
- *Part 7: Conformance testing*
- *Part 8: Extraction and use of MPEG-7 descriptions*
- *Part 9: Profiles and levels*
- *Part 10: Schema definition*
- *Part 11: MPEG-7 profile schemas*
- *Part 12: Query format*
- *Part 13: Compact descriptors for visual search*

Introduction

This International Standard, also known as "Multimedia Content Description Interface," 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 following are specified in this International Standard:

Description schemes (DS) describe entities or relationships pertaining to multimedia content. Description schemes specify the structure and semantics of their components, which may 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 International Standard is subdivided into 13 parts:

Part 1 – Systems: specifies the tools for preparing descriptions for efficient transport and storage, compressing descriptions, and allowing synchronization between content and descriptions.

Part 2 – Description definition language: specifies the language for defining the International Standard set of description tools (DSs, Ds, and datatypes) and for defining new description tools.

Part 3 – Visual: specifies the description tools pertaining to visual content.

Part 4 – Audio: specifies the description tools pertaining to audio content.

Part 5 – Multimedia description schemes: specifies the generic description tools pertaining to multimedia including audio and visual content.

Part 6 – Reference software: provides a software implementation of the International Standard.

Part 7 – Conformance testing: specifies the guidelines and procedures for testing conformance of implementations of the International Standard.

Part 8 – Extraction and use of MPEG-7 descriptions: provides guidelines and examples of the extraction and use of descriptions.

Part 9 – Profiles and levels: provides guidelines and standard profiles.

Part 10 – Schema definition: specifies the schema using description definition language.

Part 11 – Profile Schemas: listing of profile schemas using description definition language.

Part 12 – Query format: contains the tools of the MPEG Query Format (MPQF)

Part 13 – Compact descriptors for visual search: specifies an image description tool for visual search applications

This part of ISO/IEC 15938 contains simulation software for tools defined in parts 1, 2, 3, 4 and 5 of ISO/IEC 15938. This software has been derived from the verification models used in the process of developing the International Standard.

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 bit streams of descriptors and description schemes with normative syntax. The performance of these software tools should not be taken as 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 sections of part 1-5.

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Information technology — Multimedia content description interface — Part 6: Reference software

1 Scope

This International Standard operates on and generates conformant bitstreams. This International Standard provides a specific implementation that behaves in a conformant manner. In general, other implementations that conform to ISO/IEC 15938 are possible that do not necessarily use the algorithms or the programming techniques of the reference software.

The software contained in this part of ISO/IEC 15938 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 of this document.
- b) DDL parser and DDL validation parser. The components of this software module are specified in Clause 6 of this document.
- c) Visual descriptors. This software creates standard visual descriptions from associated (visual) media content as explained in Clause 7 of this document. 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 of this document. 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 of this document.

2 Symbols and abbreviated terms

For the purposes of this part of ISO/IEC 15938, the following symbols and abbreviated terms apply:

AV:	Audio-visual
CS:	Coding Scheme
D:	Descriptor
Ds:	Descriptors
DCT:	Discrete Cosine Transform
DDL:	Description Definition Language
DS:	Description Scheme
DSs:	Description Schemes
ISO:	International Organization for Standardization
MDS:	Multimedia Description Schemes
MPEG:	Moving Picture Experts Group
MPEG-7:	Multimedia Content Description Interface Standard (see ISO/IEC 15938)
XML:	Extensible Markup Language

3 Copyright disclaimer for software modules

Each source code module in this specification 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"

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4 XM software architecture

4.1 Block diagrams

This section provides information about the XM software architecture. The block diagrams give short overviews, and introduce individual components of the XM software. This section also provides the directory locations for the different modules.

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". We can distinguish from the functional point of view:

- "Extraction Applications" (a description data base is built from a media data base)
- "Search and Retrieval Applications" (a description is compared with the descriptions in a database to find the one with the lowest distance)
- "Transcoding Applications" (a media data base is converted into another media data base based on its description)

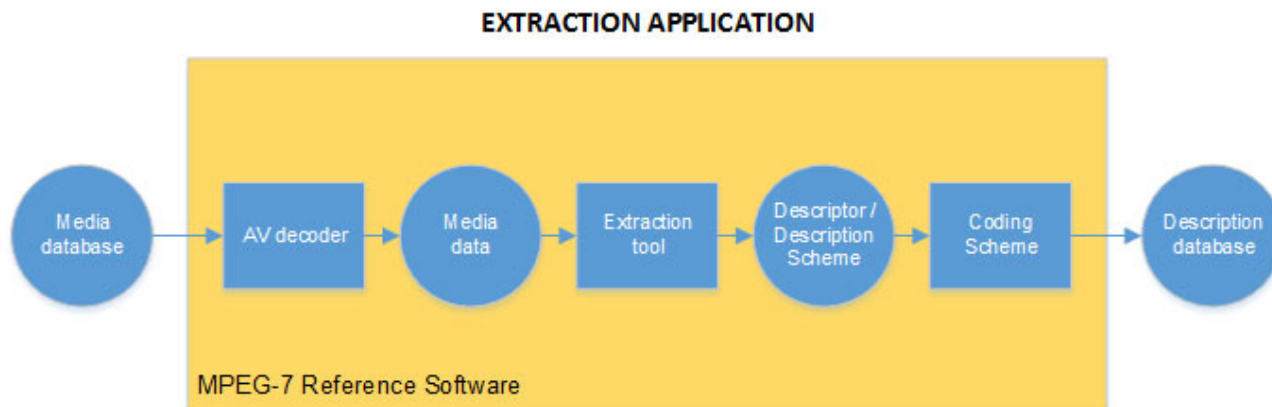


Figure 1 — Schematic diagram of an "Extraction Application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures.

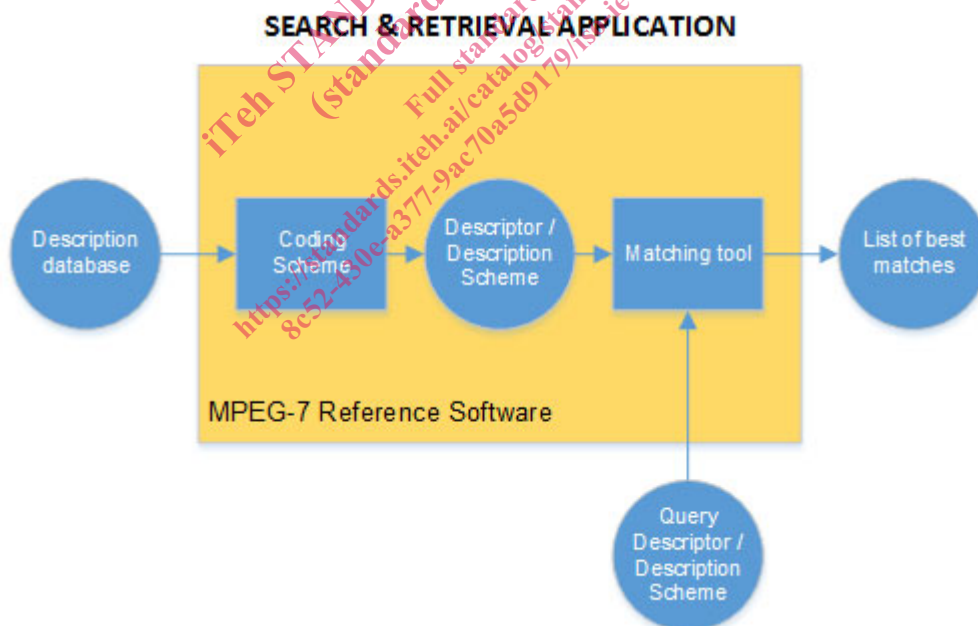


Figure 2 — Schematic diagram of a "Search and Retrieval Application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures.

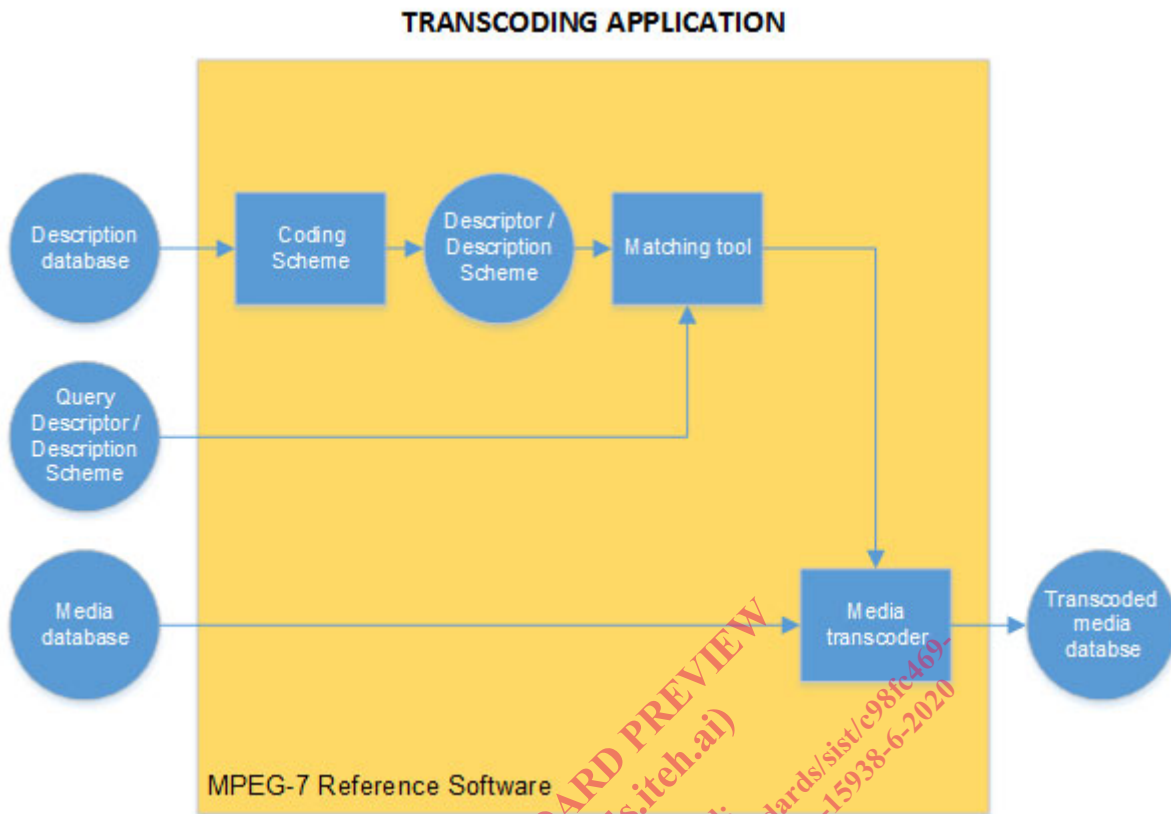


Figure 3 — Schematic diagram of a "Transcoding Application" using the XM reference software modules, with boxes representing procedural parts and circles representing data structures.

In the following, 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.

4.1.1 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.

4.1.2 AV decoders

The XM supports the following AV decoders:

- Still image decoders: ImageMagick (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).
- 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 using external library AFsp version v5r2 from McGill University.

4.1.3 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.

4.1.4 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 given below:

```
//=====
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 form 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);
};
```