INTERNATIONAL STANDARD

**ISO/IEC 14496-5**

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# Information technology — Coding of audio-visual objects —

## Part 5: Reference software

*Technologies de l'information — Codage des objets audiovisuels —*

*Partie 5: Logiciel de référence*

Reference number
ISO/IEC 14496-5:2000(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. 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 part of ISO/IEC 14496 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 14496-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 14496 consists of the following parts, under the general title *Information technology — Coding of audio-visual objects*:

— *Part 1: Systems*

— *Part 2: Visual*

— *Part 3: Audio*

— *Part 4: Conformance testing*

— *Part 5: Reference software*

— *Part 6: Delivery Multimedia Integration Framework (DMIF)*

Annexes A to C of this part of ISO/IEC 14496 are for information only.

# Introduction

This part of ISO/IEC 14496 contains simulation software for tools defined in parts 1, 2, 3 and 6 of ISO/IEC 14496. This software has been derived from verification models used in the process of developing the standard. Due to the delay between acceptance of a tool and its availability in source code form, the source for some tools described in other parts of ISO/IEC 14496 may not be present.

Where bitstream encoding software is provided, attention is called to the fact that these encoders are provided for the purpose of creating bitstreams with normative syntax. The performance of these encoders 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 encoding are not specified by this specification.

# Information technology — Coding of audio-visual objects —

# Part 5: Reference software

## 1 Scope

Reference software is normative in the sense that any conforming implementation of the software, taking the same conformant bitstreams, using the same output file format, will output the same file. Complying ISO/IEC 14496 implementations are not expected to follow the algorithms or the programming techniques used by the reference software. Although the decoding software is considered normative, it cannot add anything to the textual technical description included in parts 1, 2, 3 and 6 of ISO/IEC 14496.

The software contained in this part of ISO/IEC 14496 is divided into three categories:

a) **Elementary stream decoding software** is catalogued in clauses 3, 4, and 5. This software accepts elementary streams encoded according to the normative specification in parts 1, 2, 3, and 6 of ISO/IEC 14496 and decodes the streams into the media types associated with each elementary stream. While this software appears in the normative part of this specification, attention is drawn to the fact that the implementation techniques used in this software are not considered normative – several different implementations could produce the same result – but the software is considered normative in that it correctly implements the decoding processes described in parts 1, 2, 3, and 6 of ISO/IEC 14496.

b) **Elementary stream encoding software** is catalogued in Annex A (informative). This software creates elementary streams from associated media types. The encoders are provided as a means to obtain elementary streams with the normative syntax described in parts 1, 2, and 3 of ISO/IEC 14496. The techniques used for encoding are not specified by this specification, and the quality and complexity of these encoders has not been optimized.

c) **Utility software** is catalogued in Annex B (informative). This software was found useful by the developers of the standard, but may not conform to the normative specifications given in parts 1, 2, 3, and 6 of ISO/IEC 14496.

File locations given in this part of ISO/IEC 14496 are expressed relative to its location in the source tree.

## 2 Copyright disclaimer for software modules

Each source code module in this specification contains 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-2 AAC (ISO/IEC 13818-7), MPEG-4 System (ISO/IEC 14496-1), MPEG-4 Video (ISO/IEC 14496-2), MPEG-4 Audio (ISO/IEC 14496-3).

"This software module was originally developed by <FN1> <LN1> (<CN1>)[1)] 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 ©199_".

# 3 Audio reference software

## 3.1 Natural audio

| Location | Notes |
|---|---|
| Audio/Natural/mp4mcdec990224 | Decoder for multichannel t/f streams |
| Audio/Natural/v1refsoft990809 | Decoder for natural audio elementary streams |

## 3.2 Structured audio

| Location | Notes |
|---|---|
| Audio/SNHC/saol | Decoder for structured audio |
| Audio/SNHC/saol | Test bitstreams for structured audio |

## 3.3 Text to speech interface

| Location | Notes |
|---|---|
| Audio/SNHC/ttsi | Text to speech decoder |

## 3.4 Audio composition software

| Location | Notes |
|---|---|
| Audio/SNHC/ac | |

# 4 Visual reference software

## 4.1 Natural video

### 4.1.1 C language implementation

| Location | Notes |
|---|---|
| Visual/Natural/MoMuSys-FDIS-V1.0-990812 | Decoder implemented in ANSI C |

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

#### 4.1.2 C++ language implementation

| Location | Notes |
|---|---|
| Visual/Natural/microsoft-vfdis-v10-990812 | Decoder implementeds in C++ |

### 4.2 Facial animation

#### 4.2.1 FAP decoder

| Location | Notes |
|---|---|
| Visual/SNHC/rockwell | FAP decoder |
| Visual/SNHC/dct | DCT-based FAP decoder |
| Visual/SNHC/IST/codec | FAP decoder |

#### 4.2.2 FIT decoder

| Location | Notes |
|---|---|
| Visual/SNHC/Fit | FIT decoder |
| Visual/SNHC/fit_liu | FIT decoder |

### 4.3 2D Mesh

| Location | Notes |
|---|---|
| Visual/SNHC/Mesh2d | Dynamic 2D mesh geometry and motion decoding |

### 4.4 View-dependent texture

| Location | Notes |
|---|---|
| Visual/SNHC/rockwell_vds2 | View-dependent texture decoding with back channel |

## 5 Systems reference software

### 5.1 Core code

| Location | Notes |
|---|---|
| Systems/Im1Core | described in document Systems/Systems.doc |

# Annex A
(informative)

# Bitstream encoding software

## A.1 Audio encoding software

### A.1.1 Natural audio

| Location | Notes |
|---|---|
| Audio/Natural/mp4mcenc990224 | Encoder for multichannel t/f streams |
| Audio/Natural/v1refsoft990809 | Encoder for natural audio elementary streams |

### A.1.2 Structured audio

| Location | Notes |
|---|---|
| Audio/SNHC/saol | Encoder for structured audio |

### A.1.3 Text to speech interface

| Location | Notes |
|---|---|
| Audio/SNHC/ttsi | Text to speech encoder |

## A.2 Visual encoding software

### A.2.1 Natural video

#### A.2.1.1 C language implementation

| Location | Notes |
|---|---|
| Visual/Natural/MoMuSys-FDIS-V1.0-990812 | Encoder implemented in ANSI C |

#### A.2.1.2 C++ language implementation

| Location | Notes |
|---|---|
| Visual/Natural/microsoft-vfdis-v10-990812 | Encoder implemented in C++ |

### A.2.2 Facial animation

| Location | Notes |
|---|---|
| Visual/SNHC/rockwell | FAP encoder |
| Visual/SNHC/dct | DCT-based FAP encoder |
| Visual/SNHC/IST/codec | FAP encoder |

### A.2.3 FIT decoder

| Location | Notes |
|---|---|
| Visual/SNHC/Fit | FIT encoder |
| Visual/SNHC/fit_liu | FIT encoder |

### A.2.4 2D Mesh

| Location | Notes |
|---|---|
| Visual/SNHC/Mesh2d | Dynamic 2D mesh geometry and motion encoding |

### A.2.5 View-dependent texture

| Location | Notes |
|---|---|
| Visual/SNHC/rockwell_vds2 | View-dependent texture encoding with back channel |

## A.3 Systems encoding software

### A.3.1 BIFS encoder

| Location | Notes |
|---|---|
| Systems/Im1Core/Bifsenc | described in document Systems/Systems.doc |

# Annex B
(informative)

# Additional utility software

Software that appears in this Annex has proven to be useful to the developers of this part of ISO/IEC 14496 but is not a normative reference implementation.

## B.1 Visual utility software

### B.1.1 FAP polygon-based renderer

| Location | Notes |
|---|---|
| Visual/SNHC/miraface5.0 | |
| Visual/SNHC/IST/Face | |

### B.1.2 Face renderer demonstrating FAT tables and FDP node

| Location | Notes |
|---|---|
| Visual/SNHC/ATT | |

### B.1.3 FAP wireframe renderer

| Location | Notes |
|---|---|
| Visual/SNHC/wireface | |

### B.1.4 Mesh-based 2D video object rendering utility

| Location | Notes |
|---|---|
| Visual/SNHC/Mesh2D | |

### B.1.5 Renderer and Description of a 3D face model

| Location | Notes |
|---|---|
| Visual/SNHC/IST | |

## B.2 Systems utility software

### B.2.1 Multiplexer

| Location | Notes |
|---|---|
| Systems/Mux | file-based multiplexer |

# Annex C
(informative)

# Providers of reference software

The following organizations have contributed software referenced in this part of ISO/IEC 14496:

ACTS – MoMuSys
AT&T
CCETT
Centre Mathematique et Morphol. (CMM)
CNET
CSELT
Deutsche Telekom Berkom
Dolby Laboratories
Eastman Kodak
E-mu Systems
ENST
EPFL
ETRI
FhG
Five Bats Research
Heinrich Hertz Institut (HHI)
Hughes Electronics
Instituto Superior Tecnico (IST)
KPN Research
Lucent Technologies
Matsushita
Microsoft
MIRALab/LIG
MIT Media Lab
NEC
Nokia
NTT
Philips
Polytechn. University of Catalunya (UPC)
Polytechn. University of Madrid (UPM)
Queen Mary & Westfield College (QMW)
Robert Bosch GmbH
Rockwell
Samsung
Sarnoff Labs
Siemens AG
Sony
Telefonica I+D
Telenor
Teltec/DCU
Texas Instruments
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