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

**Part 17:  
Multiple sensorial media application  
format**

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

*Partie 17: Format pour application multimédia sensorielle*

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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.

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](http://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](http://www.iso.org/patents)).

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](http://www.iso.org/iso/foreword.html).

This document was prepared by 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](http://www.iso.org/members.html).

## Introduction

Along with the sensation associated with the 3D film industry, the development of MulSeMedia (multiple sensorial media), or 4D media, has received much attention from the public. 4D movies generally add sensory effects to 3D and/or IMAX movies, allowing audiences to immerse themselves more deeply in the movie viewing experience. Along with the two human senses of sight and hearing, sensory effects such as wind, vibration, scent and others can stimulate other senses, such as the tactile and olfaction senses.

The multiple sensorial media application format (MSMAF) defines a file format for multiple sensorial media services. It specifies core structures of multiple sensorial media application format being organized by the combination of related information for multiple sensorial media applications.

Services using the MSMAF can be realized in two ways: offline and online. The offline services include DVDs and movie plays in theatres, whereas the online services include streaming services on IP-TV or broadcasting with MPEG-2 transport streams.

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

## Part 17: Multiple sensorial media application format

### 1 Scope

This document specifies a file format which is capable of storage, interchange, management, editing and presentation of multiple sensorial media contents based on the ISO base media file format. The file format provides the overall structure for storing multiple sensorial media contents.

### 2 Normative references

There are no normative references in this document.

### 3 Terms and definitions

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

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

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

#### 3.1 sensory effect metadata

record that defines the description schemes and descriptors to represent sensory effects

#### 3.2 sensory effect

effect to augment perception by stimulating human senses in a particular scene of a multimedia application

Note 1 to entry: Combinations of tactile display may also provide directional, shape information.

EXAMPLE Scent, wind, light, haptic (kinesthetic-force, stiffness, weight, friction, texture, widget (button, slider, joystick), tactile: air-jet, suction pressure, thermal, current and vibration.

### 4 Abbreviations

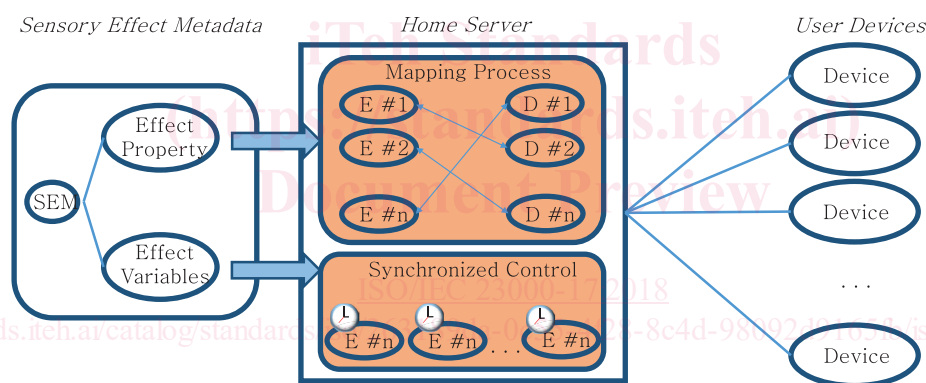
<b>BiM</b>	binary MPEG format for XML (ISO/IEC 23001-1)
<b>DIA</b>	digital item adaptation (ISO/IEC 21000-7)
<b>MPEG-21</b>	multimedia framework (ISO/IEC 21000)
<b>MPEG-7</b>	multimedia content description interface (ISO/IEC 15938)
<b>SEDL</b>	sensory effects description language (ISO/IEC 23005-3)

<b>SEM</b>	sensory effect metadata (ISO/IEC 23005-3)
<b>SEV</b>	sensory effects vocabulary (ISO/IEC 23005-3)
<b>XML</b>	extensible mark-up language
<b>XSI</b>	XML streaming instructions (ISO/IEC 21000-7)

## 5 Overview

### 5.1 Overview of sensory effect metadata (SEM)

It is necessary to play multiple sensorial media that contains metadata for representing real-sense effects according to the scenes of the media. In order to satisfy this requirement, sensory effect metadata (SEM) was standardized in ISO/IEC 23005-3. The SEM is metadata for representing 4D real-sense effects and consists of two main parts: effect property and effect variable. The effect property can be transferred in front of a media stream or transferred periodically for preparing channel switching. The effect variables can also easily fragmented and transferred by the unit of a time slice. The effect property contains the definition of each sensory effect applied to multiple sensorial media. After analysing the effect property, representing devices like a home server can map each sensory effect to a proper 4D device in the user's environment. The effect variables contain control variables to operate 4D real-sense devices. [Figure 1](#) shows the SEM processing architecture.



**Figure 1 — SEM processing architecture for representing 4D effects**

[Table 1](#) shows some examples of effects and corresponding properties and [Table 2](#) shows variables and mapped device commands. This system can support wind, shading, heating, motion, light, flash, diffusion, sting, tickler, air jet and water sprayer effects to define properties and control devices.

**Table 1 — Examples of effects and corresponding properties**

Effects	SEMs
Wind	<SEM><Effect xsi:type="sev:WindType" id="WindEffect_1" activate="true" pts="0" duration="1" intensity-value="10.0" intensity-range="0.0 12.0"/></SEM>
Incline	<SEM><Effect xsi:type="sev:RigidBodyMotionType" id="MotionEffect_1" activate="true" pts="42" duration="5"><sev:Incline pitch="45" roll="0" yaw="0" pitchSpeed="10"/></Effect></SEM>
Wave	<SEM><DescriptionMetadata><ClassificationSchemeAlias alias="WAVE" href="urn:mpeg:mpeg-v:01-SI-WaveDirectionCS-NS"/><ClassificationSchemeAlias alias="WAVESTR" href="urn:mpeg:mpeg-v:01-SI-WaveStartDirectionCS-NS"/></DescriptionMetadata> <Effect xsi:type="sev:RigidBodyMotionType" id="MotionEffect_2" activate="true" pts="25" duration="9"><sev:Wave direction=":WAVE:front_rear" startDirection=":WAVESTR:up" count="3" distance="10"/></Effect></SEM>

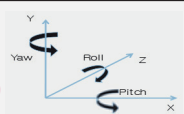

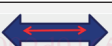


Table 1 (continued)

Effects	SEMs
Shake	<pre>&lt;SEM&gt;&lt;DescriptionMetadata&gt;&lt;ClassificationSchemeAlias alias="SHAKE" href="urn:mpeg:mpeg-v:01-SI-ShakeDirectionCS-NS"/&gt;&lt;/DescriptionMetadata&gt; &lt;Effect xsi:type="sev:RigidBodyMotionType" id="MotionEffect_3" activate="true" pts="67" duration="2"&gt;&lt;sev:Shake direction=":SHAKE:Heave" count="1" distance="20"/&gt;&lt;/Effect&gt;&lt;/SEM&gt;</pre>
LED	<pre>&lt;SEM&gt;&lt;Effect xsi:type="sev:LightType" id="LEDEffect_1" activate="true" pts="81" duration="30" intensity-value="100.0" intensity-range="0.00001 32000.0" color="#FFFFFF"/&gt;&lt;/SEM&gt;</pre>
Scent	<pre>&lt;SEM&gt;&lt;DescriptionMetadata&gt;&lt;ClassificationSchemeAlias alias="SCENT" href="urn:mpeg:mpeg-v:01-SI-ScentCS-NS"/&gt;&lt;/DescriptionMetadata&gt; &lt;Effect xsi:type="sev:ScentType" id="ScentEffect_1" activate="true" pts="23" duration="4" intensity-value="9.0" intensity-range="0.0 10.0" scent=":SCENT:lilac"/&gt;&lt;/SEM&gt;</pre>

Table 2 shows an example of SEM. Each SEM data will be parsed, analysed and then changed into proper control values.

Table 2 — Effect variables and selected device commands

Effects	Variables	Device command
Wind	SetWindSpeedRatio=100	Turn on fan with maximum level
Incline	SetIncline pitch="45" roll="0" yaw="0", pitchSpeed=10	 Incline motion chair to front angle 45 degrees with speed 10 cm/sec
Wave	SetWave direction="front_rear" startDirection="up" count="3" distance="10"	 Wave motion chair from front-up to rear-down, 3 times, 10 cm
Shake	SetShake direction="Heave" count="1" distance="20"	 Shake motion chair from up to down, 1 time, 20 cm.
LED	SetColor r="255" g="255" b="255"	Turn on led light "white"
Scent	SetOnOff=True, SetDensityRatio=100, SetDiffusionSourceID=1	Turn on diffuser value number "1" to make strong (100 %) smell

## 5.2 Fragmentation of SEM

### 5.2.1 SEM streaming instruction

The SEM root element, the GroupOfEffects element, Effect element, and ReferenceEffect element in ISO/IEC 23005-3 can contain the siAttributeList that is the XML streaming instruction specified in ISO/IEC 21000-7. The XML streaming instructions allow firstly to identify process units in an XML document and secondly to assign time information to them.

A process unit is a set of connected XML elements. It is specified by one element, named an anchor element, and by a process unit mode indicating how other connected elements are aggregated to this anchor to compose the process unit. Depending on the mode, the anchor element is not necessarily the root of the process unit. The content provider may require that a given process unit be encoded as a random access point.

The main functionalities of the XML streaming instruction are as follows:

- fragmenting an XML document into process units;
- indicating which process units shall be encoded as random access point;
- assigning time information (i.e., processing time stamp) to these process units.

### 5.2.2 Properties related to the fragmentation

The properties related to the fragmentation are specified as follows.

- **anchorElement** is one of {undefined, false, true}. When set to true, this property indicates an anchor element. This property is not inherited and its default value is undefined.
- **puMode** is one of {undefined, self, ancestors, descendants, ancestorsDescendants, preceding, sequential}. The process unit mode property specifies how elements are aggregated to the anchor element to compose a process unit. This property is inherited and its default value is undefined.
  - **self**: the process unit contains only the anchor element.
  - **ancestors**: the process unit contains the anchor element and its ancestors stack, i.e., its ancestors elements.
  - **descendants**: the process unit contains the anchor element and its descendant elements.
  - **ancestorsDescendants**: the process unit contains the anchor element, its ancestor, and descendant element (Figure 2).
  - **preceding**: the process unit contains the anchor element, its descendant and parent elements, and all the preceding-sibling elements of its ancestor elements and their descendants.
  - **precedingSiblings**: the process unit contains the anchor element, its descendant and parent elements, and all the preceding-sibling elements (and their descendants) of its ancestor elements.
  - **sequential**: the process unit contains the anchor element, its ancestors stack, and all the following elements (i.e., descendants, following siblings, and their ancestors) until a next element is flagged as an anchor element.

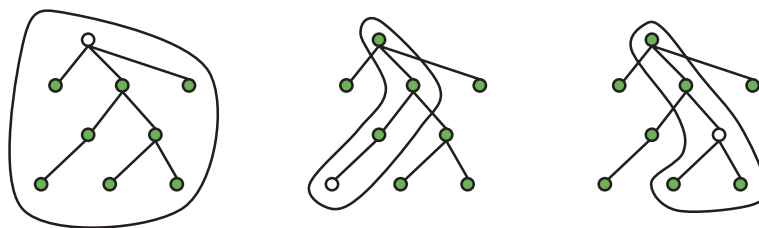


Figure 2 — Example of process unit – puMode = ancestorsDescendants

- **encodesAsRAP** is one of {undefined, false, true}. When set to true, this property indicates that the process unit shall be encoded as a random access point. This property is inherited and its value is undefined.

### 5.2.3 Properties related to time information

The processing time stamp of a process unit defines the point in time where it is available to the application for consumption. It is specified by the set of time properties of the PU's anchor element. There are two defined time modes: an **absolute time mode** where the PUs' PTS are specified according