
**Information technology — Media context
and control —**

**Part 3:
Sensory information**

Technologies de l'information — Contrôle et contexte de supports —

Partie 3: Information 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.

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.

ISO/IEC 23005-3 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 23005 consists of the following parts, under the general title *Information technology — Media context and control*:

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— Part 1: Architecture

— Part 2: Control information

— Part 3: Sensory information

— Part 4: Virtual world object characteristics

— Part 5: Data formats for interaction devices

— Part 6: Common types and tools

— Part 7: Conformance and reference software

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Introduction

The usage of multimedia content is becoming omnipresent in our everyday life, in terms of both consumption and production. On the one hand, professional content is provided to the end user in high-definition quality, streamed over heterogeneous networks, and consumed on a variety of different devices. On the other hand, user-generated content overwhelms the Internet with multimedia assets being uploaded to a wide range of available Web sites. That is, the transparent access to multimedia content, which is also referred to as Universal Multimedia Access (UMA), seems to be technically feasible. However, UMA mainly focuses on the end-user devices and network connectivity issues, but it is the user who ultimately consumes the content. Hence, the concept of UMA has been extended to take the user into account, which is generally referred to as Universal Multimedia Experience (UME).

However, the consumption of multimedia assets can also stimulate senses other than vision or hearing, e.g., olfaction, mechanoreception, equilibrioception, or thermoception. That is, in addition to the audio-visual content of, e.g., a movie, other senses shall also be stimulated giving her/him the sensation of being part of the particular media which shall result in a worthwhile, informative user experience.

This motivates the annotation of the media resources with metadata as defined in this part of ISO/IEC 23005, which steers appropriate devices capable of stimulating these other senses.

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

The holders of these patent rights have assured ISO and the IEC that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with ISO and the IEC. Information may be obtained from the companies listed in Annex C.

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2 Normative references

The following referenced documents are indispensable for the specification 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 15938-5, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 21000-7:2007, *Information technology — Multimedia framework (MPEG-21) — Part 7: Digital Item Adaptation*

ISO/IEC 23005 (all parts), *Information technology — Media context and control*

IETF RFC 2045, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*, IETF Request for Comments: 2045, November 1996

IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*, IETF Request For Comments: 3986, January 2005

W3C XML, *Extensible Markup Language (XML) 1.1, Second Edition*, W3C Recommendation 16 August 2006, edited in place 29 September 2006

W3C XMLSCHEMA, *XML Schema Part 1: Structures and XML Schema*, Second Edition W3C Recommendation, 28 October 2004

W3C XMLSCHEMA, *XML Schema Part 2: Datatypes*, Second Edition W3C Recommendation, 28 October 2004

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3 Terms, definitions, symbols, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in ISO/IEC 23005 (all parts) and the following apply.

3.1.1 digital content provider

entity that acts as the source of digital information of various nature

NOTE The digital content may be provided in real-time or non real-time.

EXAMPLE Digital content from an on-line virtual world, simulation environment, multi user game, broadcasted multimedia production, peer-to-peer multimedia production, or packaged content like a DVD or game.

3.1.2 sensory information

standardized representation format of ISO/IEC 23005 in the standardization area B as defined in ISO/IEC 23005-1

EXAMPLE Sensory effect metadata, haptic (kinesthetic/tactile) information, emotion information, avatar information.

3.1.3 sensory effect metadata

defines the description schemes and descriptors to represent **sensory effects**

3.1.4

sensory effect

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

EXAMPLE Scent, wind, light, haptic (kinesthetic-force, stiffness, weight, friction, texture, widget (button, slider, joystick); tactile: air-jet, suction pressure, thermal, current, vibration. Combinations of tactile display can also provide directional, shape information.

3.1.5

adaptation VR

entity that can process the **sensory information** in order to be consumed within the real world's context

NOTE This may include the adaptation or transformation of the sensory information according to the capabilities of real world devices or the preferences of the user. A specification of these capabilities and preferences can be found in ISO/IEC 23005-2.

3.2 Symbols and abbreviated terms

For the purpose of this document, the symbols and abbreviated terms given in the following apply:

DIA	digital item adaptation (ISO/IEC 21000-7)
MPEG-21	multimedia framework (ISO/IEC 21000)
MPEG-7	multimedia content description interface (ISO/IEC 15938)
SEDL	sensory effects description language
SEM	sensory effect metadata
SEV	sensory effects vocabulary ISO/IEC 23005-3:2011
UMA	universal multimedia access
UME	universal multimedia experience
XML	extensible mark-up language
XSI	XML streaming instructions

4 Schema documents

In the main text of this specification, the syntax of description schemes and descriptors is provided whenever possible as a single schema document.

In some cases though, and in particular for the clause 5, the syntax of description schemes and descriptors is provided as a collection of schema snippets imbricated with other text. In order to form a valid schema document, these schema components should be gathered in a same document with the schema wrapper provided at the head of the clause. For better readability, the relevant schema documents are provided in the Annex B, but as non-normative information.

In all cases, each schema document has a `version` attribute, the value of which is "ISO/IEC 23005-3". Furthermore, an informative identifier is given as the value of the `id` attribute of the `schema` component. This identifier is non-normative and used as a convention in this specification to reference another schema document. In particular, it is used for the `schemaLocation` attribute of the `include` and `import` schema components.

4.1 Use of prefixes

For clarity, throughout this Part of ISO/IEC 23005, consistent namespace prefixes are used.

"xsi:" prefix is not normative. It is a naming convention in this document to refer to an element of the <http://www.w3.org/2001/XMLSchema-instance> namespace.

"xml:" and "xmlns:" are normative prefixes defined in [1]. The prefix "xml:" is by definition bound to "<http://www.w3.org/XML/1998/namespace>". The prefix "xmlns:" is used only for namespace bindings and is not itself bound to any namespace name.

All other prefixes used in either the text or examples of this specification are not normative, e.g., "sedl:", "sev:", "dia:", "si:", "mpeg7:".

In particular, most of the informative examples in this specification are provided as XML fragments without the normally required XML document declaration and, thus, miss a correct namespace binding context declaration. In these descriptions fragments the different prefixes are bound to the namespaces as given in the following table.

Table 1 — Mapping of prefixes to namespaces in examples and text.

Prefix	Corresponding namespace
ct	urn:mpeg:mpeg-v:2010:01-CT-NS
sedl	urn:mpeg:mpeg-v:2010:01-SEDL-NS
sev	urn:mpeg:mpeg-v:2010:01-SEV-NS
dia	urn:mpeg:mpeg21:2003:01-DIA-NS
si	urn:mpeg:mpeg21:2003:01-DIA-XSI-NS
mpeg7	urn:mpeg:mpeg7:schema:2004
xsi	http://www.w3.org/2001/XMLSchema-instance
xsd	http://www.w3.org/2001/XMLSchema

Unlike the informative descriptions examples, the normative specification of the syntax of tools in XML Schema follows the namespace binding context defined in the relevant schema declaration such as the one defined in 5.3.

4.2 Sensory effects description language

4.3 Introduction

This Clause specifies the syntax and semantics of the sensory effects description language (SEDL) which provides basic building blocks for the authoring of sensory effect metadata.

4.4 Validation

Validating a document against the SEDL schema (as specified in W3C XMLSCHEMA) is necessary, but not sufficient, to determine its validity with respect to SEDL. After a document is validated against the SEDL schema, it shall also be subjected to additional validation rules. These additional rules are given below in the descriptions of the elements to which they pertain.

4.5 Processing

The processing model for the sensory effect metadata is defined as an XML processor (as specified by W3C XML) and the utilization of the elements and attributes as defined in the subsequent (Sub)clauses.

NOTE The processing of the sensory effect metadata may follow existing XML decoding/parsing models such as the Document Object Model (DOM) or the Simple API for XML (SAX).

The time information that may be associated to sensory effects may be used for the synchronization with respect to other media assets.

EXAMPLE These other media assets may be video and/or audio.

4.6 Basic building blocks

4.6.1 Introduction

This Subclause specifies the syntax and semantics of the basic building blocks for authoring sensory effect metadata.

This Part of ISO/IEC 23005 adopts the XML streaming instructions (XSI) as defined in ISO/IEC 21000-7 for the purpose of identifying process units and associating time information to them. In this context, a process unit is defined as a well-formed fragment of XML-based metadata that can be consumed as such and to which time information may be attached, indicating the point in time when it becomes available for consumption. A process unit is specified by one element named 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. Anchor elements are ordered according to the navigation path of the XML document. Process units may overlap, i.e. some elements (including anchor elements) may belong to several process units. Additionally, the content provider may require that a given process unit be encoded as a random access point, i.e. that the resulting access unit does not require any other access units to be decoded. The syntax and semantics of the XML streaming instructions is fully specified in 8.6 of ISO/IEC 21000-7:2007-3-2011.

In addition to the XML streaming instructions, this standard adopts the following basic time model for sensory effects metadata which is depicted in Figure 2.

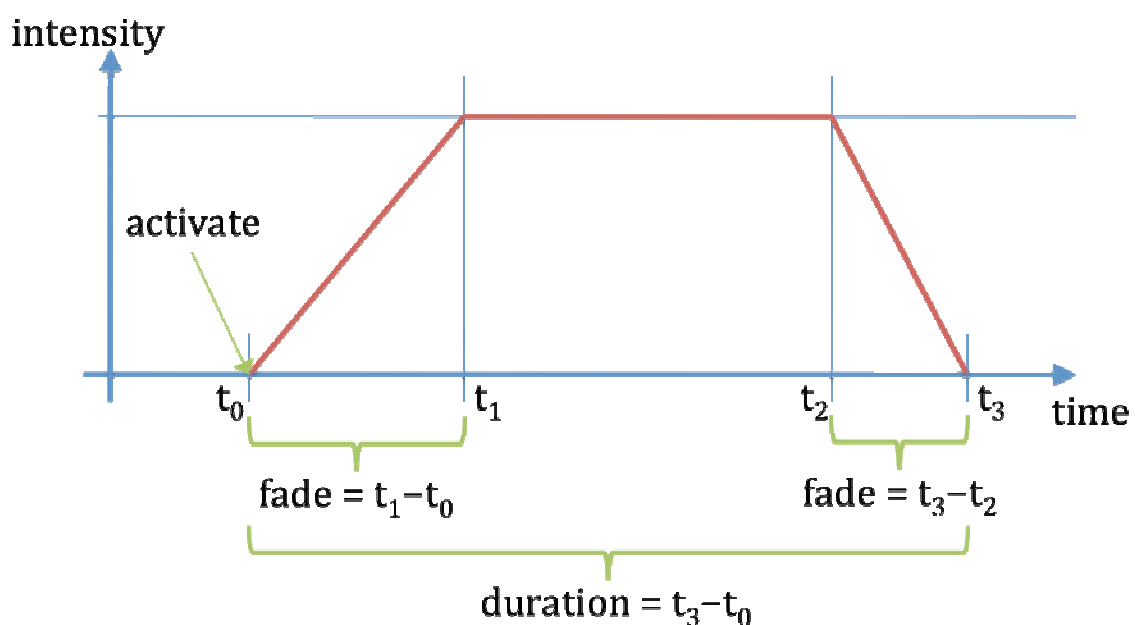


Figure 2 — Time model for sensory effect metadata

Each effect may be activated (i.e., t_0) and deactivated (i.e., t_3) at certain points in time. The deactivation of an effect may be explicitly defined (i.e., `activate="false"`) or indicated by means of a duration attribute during activation (i.e., t_3-t_0). Furthermore, each effect may specify a fade-in (i.e., t_1-t_0) or fade-out (i.e., t_3-t_2) time within which the corresponding effect shall reach its specified intensity.

NOTE The actual implementation of some effects may require one or more elements as defined in the following. An example implementation of Figure 2 using the syntax as defined in the following is provided in 4.6.12.

4.6.2 Schema wrapper

The syntax of description tools specified in this clause is provided as a collection of schema components, consisting notably in type definitions and element declarations. In order to form a valid schema document, these schema components should be gathered in a same document with the following declaration defining in particular the target namespace and the namespaces prefixes.

```
<?xml version="1.0"?>
<schema
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:sedl="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
  xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
  xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-NS"
  xmlns:ct="urn:mpeg:mpeg-v:2010:01-CT-NS"
  targetNamespace="urn:mpeg:mpeg-v:2010:01-SEDL-NS"
  elementFormDefault="qualified" attributeFormDefault="unqualified"
  version="ISO/IEC 23005-3" id="MPEG-V-SEDL.xsd">

  <import namespace="urn:mpeg:mpeg7:schema:2004"
  schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
  7_schema_files/mpeg7-v2.xsd"/>
  <import namespace="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
  schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
  21_schema_files/dia-2nd/XSI-2nd.xsd"/>
  <import namespace="urn:mpeg:mpeg21:2003:01-DIA-NS"
  schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
  21_schema_files/dia-2nd/UED-2nd.xsd"/>
  <import namespace="urn:mpeg:mpeg-v:2010:01-CT-NS" schemaLocation="MPEG-V-
  CT.xsd"/>
```

Additionally, the following line should be appended to the resulting schema document in order to obtain a well-formed XML document.

```
</schema>
```

4.6.3 Base datatypes and elements

4.6.3.1 Syntax

```

<!-- ##### -->
<!-- SEM Base Attributes -->
<!-- ##### -->
<attributeGroup name="SEMBaseAttributes">
  <attribute name="activate" type="boolean" use="optional" />
  <attribute name="duration" type="positiveInteger" use="optional" />
  <attribute name="fade" type="positiveInteger" use="optional" />
  <attribute name="alt" type="anyURI" use="optional" />
  <attribute name="priority" type="positiveInteger" use="optional" />
  <attribute name="location" type="mpeg7:termReferenceType"
    use="optional"/>
  <attributeGroup ref="sedl:SEMAdaptabilityAttributes"/>
</attributeGroup>
<simpleType name="intensityValueType">
  <restriction base="float"/>
</simpleType>
<simpleType name="intensityRangeType">
  <restriction>
    <simpleType>
      <list itemType="float"/>
    </simpleType>
    <length value="2" fixed="true"/>
  </restriction>
</simpleType>

<!-- ##### -->
<!-- SEM Adaptability Attributes -->
<!-- ##### -->
<attributeGroup name="SEMAdaptabilityAttributes">
  <attribute name="adaptType" type="sedl:adaptTypeType" use="optional" />
  <attribute name="adaptRange" type="sedl:adaptRangeType" default="10"
    use="optional" />
</attributeGroup>
<simpleType name="adaptTypeType">
  <restriction base="NMTOKEN">
    <enumeration value="strict" />
    <enumeration value="under" />
    <enumeration value="over" />
    <enumeration value="both" />
  </restriction>
</simpleType>
<simpleType name="adaptRangeType">
  <restriction base="unsignedInt">
    <minInclusive value="0" />
    <maxInclusive value="100" />
  </restriction>
</simpleType>

<!-- ##### -->
<!-- SEM Base Elements -->
<!-- ##### -->
<element name="Declarations" type="sedl:DeclarationsType" />
<element name="GroupOfEffects" type="sedl:GroupOfEffectsType" />
<element name="Effect" type="sedl:EffectBaseType" />
<element name="ReferenceEffect" type="sedl:ReferenceEffectType" />

```

```

<element name="Parameter" type="sedl:ParameterBaseType"/>□
<!-- ##### -->
<!-- SEM Base type -->
<!-- ##### -->
<complexType name="SEMBaseType" abstract="true">
  <complexContent>
    <restriction base="anyType">
      <attribute name="id" type="ID" use="optional"/>
    </restriction>
  </complexContent>
</complexType>

```

4.6.3.2 Semantics

Semantics of the SEMBaseAttributes:

Name	Definition
activate	Describes whether the sensory effect shall be activated. A value of true means the sensory effect shall be activated and false means the sensory effect shall be deactivated.
duration	Describes the duration according to the time scheme used. The time scheme used shall be identified by means of the si:absTimeScheme and si:timeScale attributes respectively.
fade	Describes the fade time according to the time scheme used within which the defined intensity shall be reached. The time scheme used shall be identified by means of the si:absTimeScheme and si:timeScale attributes respectively.
alt	Describes an alternative sensory effect identified by URI. NOTE 1 The alternative might point to a sensory effect – or list of sensory effects – within the same description or an external description. NOTE 2 The alternative might be used in case the original sensory effect cannot be processed. EXAMPLE 1 The alternative sensory effect is chosen because the original intended sensory effect cannot be processed due to lack of devices supporting this sensory effect.
priority	Describes the priority for sensory effects with respect to other sensory effects in the same group of sensory effects sharing the same point in time when they should become available for consumption. A value of one indicates the highest priority and larger values indicate lower priorities. NOTE 3 The priority might be used to process sensory effects – defined within a group of sensory effects – according to the capabilities of the adaptation VR. EXAMPLE 2 The adaptation VR processes the individual sensory effects of a group of sensory effects according to their priority in descending order due to its limited capabilities. That is, sensory effects with low priority might get lost.

Name	Definition
location	Describes the location from where the sensory effect is expected to be received from the user's perspective according to the x-, y-, and z-axis as depicted in Figure 3.

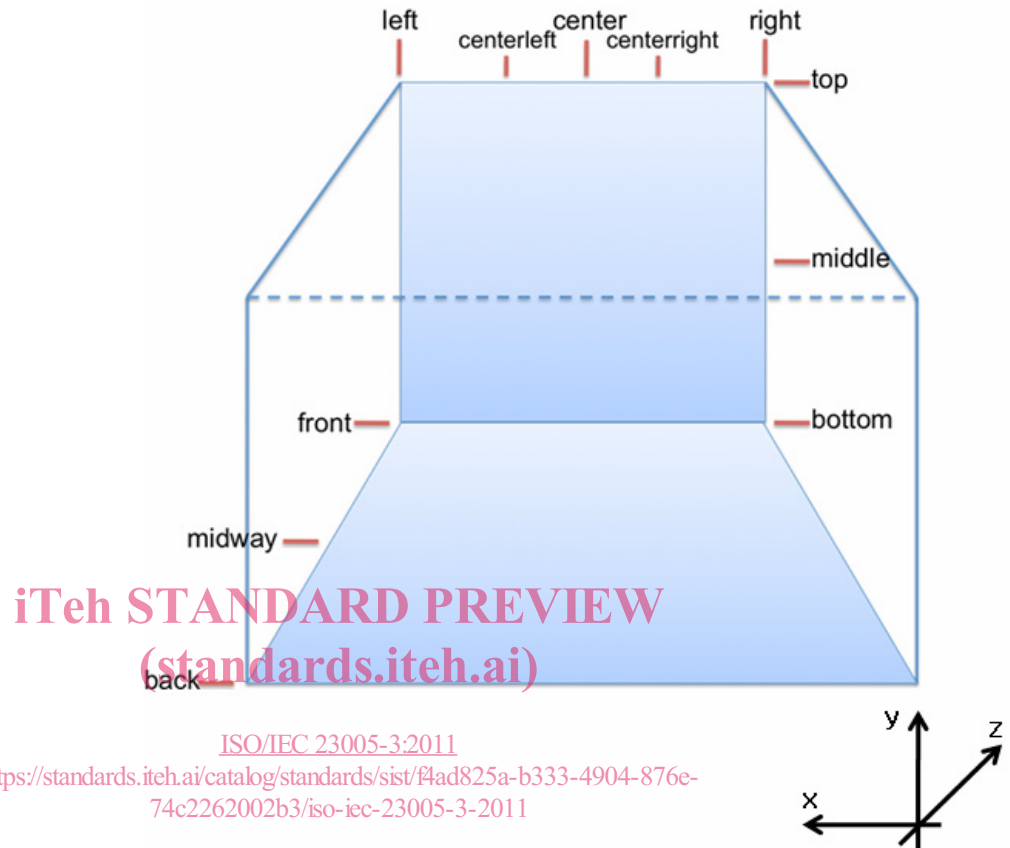


Figure 3 — Location model for sensory effect metadata and reference coordinate system

A classification scheme that may be used for this purpose is the LocationCS as defined in Annex A of ISO/IEC 23005-6. The terms from the LocationCS shall be concatenated with the ":" sign in order of the x-, y-, and z-axis to uniquely define a location within the three-dimensional space.

For referring to a group of locations, a wild card mechanism may be employed using the "*" sign.

EXAMPLE 4 urn:mpeg:mpeg-v:01-SI-LocationCS-NS:center:middle:front defines the location as follows: center on the x-axis, middle on the y-axis, and front on the z-axis. That is, it describes all sensory effects at the center, middle, front side of the user.

EXAMPLE 5 urn:mpeg:mpeg-v:01-SI-LocationCS-NS:left:*:midway defines the location as follows: left on the x-axis, any location on the y-axis, and midway on the z-axis. That is, it describes all sensory effects at the left, midway side of the user.

EXAMPLE 6 urn:mpeg:mpeg-v:01-SI-LocationCS-NS:*:*:back defines the location as follows: any location on the x-axis, any location on the y-axis, and back on the z-axis. That is, it describes all sensory effects at the back of the user.