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Information technology — Media context and control —

Part 4: Virtual world object characteristics

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

Partie 4: Caractéristiques d'objet du monde virtuel

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Foreword

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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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This third edition cancels and replaces the second edition (ISO/IEC 23005-4:2013), which has been technically revised.

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

- *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*

Introduction

This International Standard provides an architecture and specifies associated information representations to enable interoperability between virtual worlds, e.g. digital content provider of a virtual world, gaming (serious), simulation, DVD, and the real world, e.g. sensors, actuators, vision and rendering, robotics (e.g. for revalidation), (support for) independent living social and welfare systems, banking, insurance, travel, real estate, rights management and many others.

Virtual worlds (often referred to as 3D3C for 3D visualization and navigation and the 3Cs of Community, Creation and Commerce) integrate existing and emerging media technologies (e.g. instant messaging, video, 3D, VR, AI, chat, voice, etc.) that allow for the support of existing and the development of new kinds of social networks. The emergence of virtual worlds as platforms for social networking is recognized by businesses as an important issue for at least two reasons.

1) It offers the power to reshape the way companies interact with their environments (markets, customers, suppliers, creators, stakeholders, etc.) in a fashion comparable to the Internet.

2) It allows for the development of new (breakthrough) business models, services, applications and devices.

Each virtual world, however, has a different culture and audience making use of these specific worlds for a variety of reasons. These differences permit users to have unique experiences.

Although realistic experiences have been achieved via devices such as 3D audio/visual devices, it is hard to realize sensory effects only with presentation of audiovisual contents. The addition of sensory effects leads to even more realistic experiences in the consumption of audiovisual contents. This will lead to the application of new media for enhanced experiences of users in a more realistic sense.

Such new media will benefit from the standardization of control and sensory information which includes sensory effect metadata, sensory device capabilities/commands, user sensory preferences, and various delivery formats. The MPEG-V architecture can be applicable for various business models for which audiovisual contents can be associated with sensory effects that need to be rendered on appropriate sensory devices.

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

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified in Annex E. ISO and the IEC shall not be held responsible for identifying any or all such patent rights.

Information technology — Media context and control —

Part 4:
Virtual world object characteristics

1 Scope

This part of ISO/IEC 23005 specifies syntax and semantics of description schemes and descriptors used to characterize a virtual world object related metadata, making it possible to migrate a virtual world object (or only its characteristics) from one virtual world to another and to control a virtual world object in a virtual world by real world devices.

The system architecture of this International Standard is depicted in Figure 1 and the scope of this part of ISO/IEC 23005 is highlighted. That is, only the information representation that acts as an input to the possible R→V/V→R Adaptation and as an exchangeable information format to support interoperability between the virtual worlds, as defined in ISO/IEC 23005-1, is specified in this part of ISO/IEC 23005.

NOTE The actual R→V/V→R Adaptation is deliberately informative and left open for industry competition.

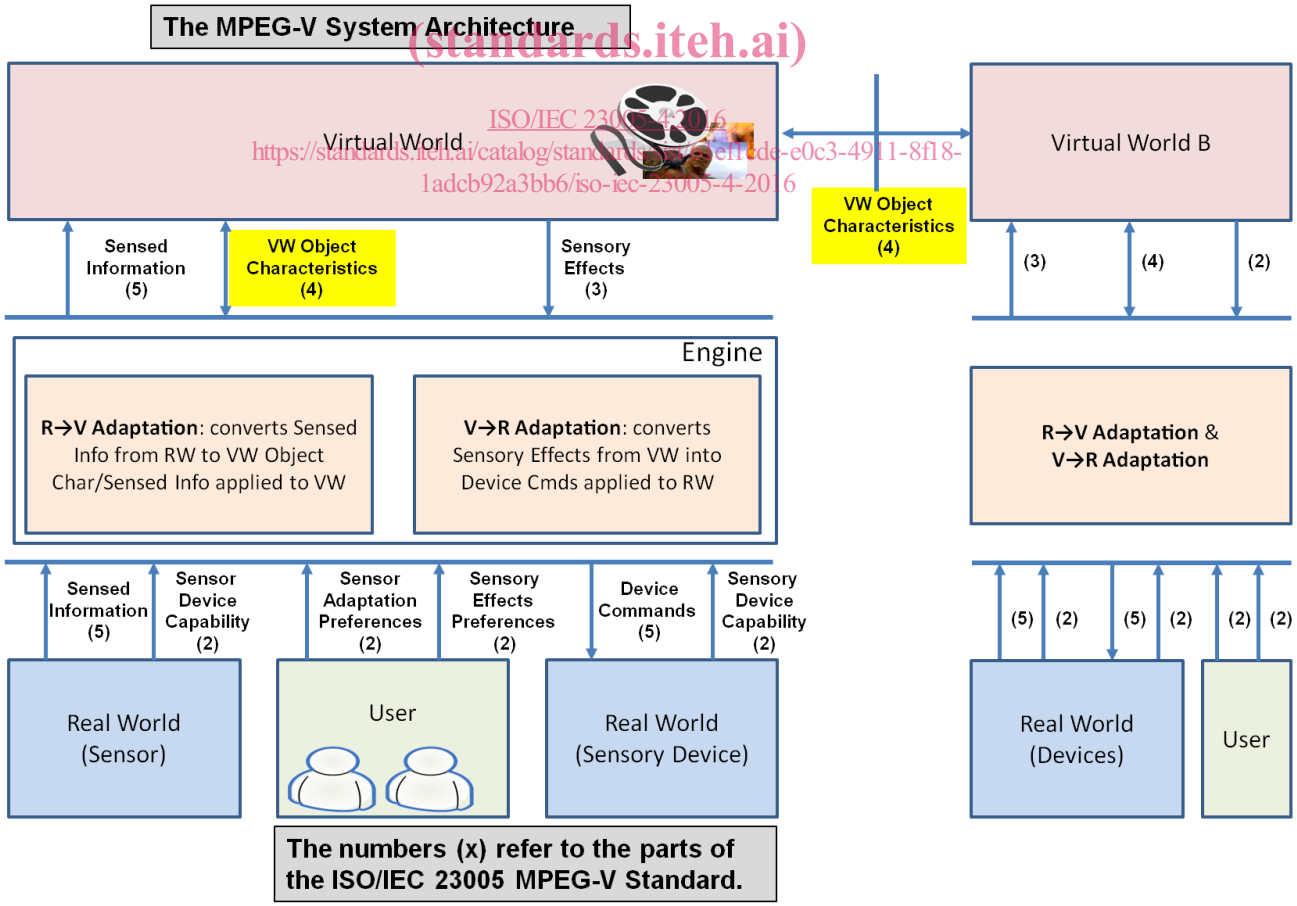


Figure 1 — System architecture

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15938-5:2003, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 21000-5, *Information technology — Multimedia framework (MPEG-21) — Part 5: Rights Expression Language*

ISO/IEC 23005-6, *Information technology — Media context and control — Part 6: Common types and tools*

3 Terms, definitions, abbreviated terms and prefixes

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO/IEC 23005-6 and the following apply.

3.1.1
avatar
entity that can be used as a (visual) representation of the user inside the virtual environments

EXAMPLE A player's representation in the video game and human or fantastic representations of a person's self in non-gaming online worlds.

3.1.2
avatar metadata
defines the description schemes and descriptors to represent *avatars* (3.1.1)

3.1.3
Extensible Markup Language
set of rules for encoding documents in machine-readable form

3.1.4
Rights expression language
machine-readable language that declares rights and permissions

3.1.5
Uniform Resource Identifier
compact string of characters for identifying an abstract or physical resource

3.1.6
Uniform Resource Locator
compact string representation for a resource available via the Internet

3.1.7
virtual object
entity that is any (visual) object except for avatars in the virtual environment

3.1.8
virtual object metadata
defines the description schemes and descriptors to represent *virtual objects* (3.1.7)

3.1.9
virtual world object
entity that includes avatars and virtual objects in the virtual world

3.1.10
virtual world object metadata
defines the description schemes and descriptors to represent *virtual world objects* (3.1.9)

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

MPEG-21	multimedia framework (ISO/IEC 21000-5)
MPEG-7	multimedia content description interface (ISO/IEC 15938-5)
REL	rights expression language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
XML	Extensible Markup Language

3.3 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 part of ISO/IEC 23005 to refer to an element of the `http://www.w3.org/2001/XMLSchema-instance` namespace.

"`xml:`" and "`xmlns:`" are normative prefixes defined in Reference [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 Table 1.

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

Prefix	Corresponding namespace
`Ct`	`urn:mpeg:mpeg-v:2016:01-CT-NS`
`Sedl`	`urn:mpeg:mpeg-v:2016:01-SEDL-NS`
`Sev`	`urn:mpeg:mpeg-v:2016:01-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`

4 Virtual world object metadata

4.1 General

A specificity of Virtual Environments (VEs) with respect to other multimedia applications consists in the representation of virtual world objects inside the environment. The "virtual world object" can be classified into

two types: avatars and virtual objects. An avatar can be used as a (visual) representation of the user inside the environment. These virtual world objects serve different purposes, namely:

— characterize various kinds of objects within the VE;

— provide an interaction with the VE.

In general, creating an object is a time-consuming task. Even though some components of the object may be related to the virtual environment (e.g. the avatar wearing a medieval suite in a contemporary style VE may be inappropriate), there is a real need of being able to create the object once and import/use it in different VEs. To serve the latter purpose, it should be possible to control the object from external applications (e.g. the emotions one avatar exposes in the VE can be obtained by processing the associated user's physiological sensors).The current standard proposes an XML Schema, called Virtual World Object Characteristics XSD, for describing an object by considering three main requirements.

— It should be possible to easily create importers/exporters from various VEs implementations.

— It should be easy to control an object within a VE.

— It should be possible to modify a proprietary template (specific to the virtual world) of the object by using data contained in Virtual World Object Characteristics file.

In detail, once the object is created possibly by an authoring tool specific to a VW, it can be used in any other VWs. In case of avatars, a user can have one's own unique presentation inside all VWs, like in real life. He can change and upgrade his avatar, i.e. "virtual himself" in one VW and then all the updated properties will be reflected in all the other VWs. The avatar itself contains representation and animation features but also higher level semantic information. However, each VW may have its own internal structure for handling avatars. ISO/IEC 23005 (MPEG-V) is not imposing any specific constraints on the internal structure of representing data by the VW, but proposes a descriptive format able to drive the transformation of a template or a creation from scratch of an avatar compliant with the VW. All the associated characteristics of the avatar (including the associated motion) can be exported from a VW and then imported to another VW. Similarly, any virtual object created by a user can also be exchangeable between VWs by exporting and importing the associated characteristics of the object. In case of interfacing between virtual worlds and the real world, the sensed real world information will be processed to obtain the meaningful data which can be used as control parameters on the associated characteristics of the object in the VW. As for avatar, the captured gesture of a user can be used to control the gesture of the avatar in the VW by updating the associated characteristics of the avatar. Similarly, the avatar motions created in the virtual world can be mapped onto a real robot for the use in dangerous areas, the maintenance tasks, the support for disabled and/or elderly people, and the like.

The proposed schema deals only with metadata and does not include representation of the geometry, sound, scent, animation or texture. To represent the latter, references to media resources are used. To provide a full interoperable solution, it may be combined with ISO/IEC 14496-16 (MPEG-4 Part 16) which includes a framework for defining and animating avatars and/or ISO/IEC 14496-11 (MPEG-4 Part 11) which includes a framework for defining graphical assets.

There is a base type of attributes and characteristics of the virtual world objects which is shared by both avatars and virtual objects.

The base type of the virtual world object characteristics is composed of following type of data:

— **identity**: contains identification descriptors;

— **sound**: contains sound resources and the related properties;

— **scent**: contains scent resources and the related properties;

— **control**: contains a set of descriptors for controlling motion features of an object such as translation, orientation and scaling;

— **event**: contains a set of descriptors providing input events from a mouse, keyboard and etc.;

— **behaviour model**: contains a set of descriptors defining the behavior information of the object according to input events;

— **id**: contains a unique identifier for identifying individual virtual world object information.

The virtual world object base type is inherited to both avatar metadata and virtual object metadata to extend the specific aspects of each of metadata.

4.2 Schema wrapper conventions

The syntax defined in this Clause assumes the following Schema Wrapper to form a valid XML schema document.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-
NS" xmlns:mpegvct="urn:mpeg:mpeg-v:2016:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2016:01-VWOC-NS" targetNamespace="urn:mpeg:mpeg-v:2016:01-VWOC-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="ISO/IEC 23005-4" id="MPEG-V-VWOC.xsd">
   <!-- ################################################ -->
   <!--  Import of reference schema                      -->
   <!-- ################################################ -->
   <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-REL-R-NS"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
21_schema_files/rel-r/rel-r.xsd"/>
   <import namespace="urn:mpeg:mpeg-v:2016:01-CT-NS"
schemaLocation="http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-
V_schema_files/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>
```

4.3 Root element and top-level tools

4.3.1 General

This subclause specifies the root element and the top-level tools which can follow root element in virtual world object characteristics information. The root element is the only element which can appear as the topmost element when the world object characteristics information specified in this part of ISO/IEC 23005 is instantiated. The top-level tools are defined as the elements which are allowed to appear as the topmost element within the root element.

4.3.2 XML representation syntax

```
<!-- ################################################ -->
<!--  Declaration of Root Element                     -->
<!-- ################################################ -->
<element name="VWOCInfo" type="vwoc:VWOCInfoType"/>

<complexType name="VWOCInfoType">
   <sequence>
      <element name="AvatarList" type="vwoc:AvatarListType" minOccurs="0"/>
      <element name="VirtualObjectList" type="vwoc:VirtualObjectListType"
minOccurs="0"/>
   </sequence>
```

```
</complexType>

<complexType name="AvatarListType">
    <sequence>
        <element name="Avatar" type="vwoc:AvatarBaseType" maxOccurs="unbounded"/>
    </sequence>
</complexType>

<complexType name="VirtualObjectListType">
    <sequence>
        <element name="VirtualObject" type="vwoc:VirtualObjectBaseType"
maxOccurs="unbounded"/>
    </sequence>
</complexType>
```

4.3.3 Binary representation syntax

	Number of bits	***Mnemonic***
VWOCInfo		VWOCInfoType
VWOCInfoType{		
AvatarListFlag	1	bslbf
VritualObjectListFlag	1	bslbf
if(AvatarListFlag){		
AvatarList		AvatarListType
}		
if(VirtualObjectListFlag){		
VirtualObjectList		VirtualObjectListType
}		
AvatarListType{		
NumAvatarType		vluimsbf5
for(k=0;k< NumAvatarType;k++){		
IndividualAvatarType	8	bslbf
Avatar		AvatarBaseType
}		
}		
VirtualObjectListType{		

NumVirtualObjectType		vluimsbf5
for(k=0;k< NumVirtualObjectType;k++){		
IndividualVirtualObjectType	16	bslbf
VirtualObject		VirtualObjectBaseType
}		
}		

4.3.4 Semantics

Name	*Description*
VWOCInfo	The root element that serves as the topmost element in the virtual world object characteristics description.
VWOCInfoType	The root type provides basic structure that the virtual world object characteristics information description should follow through the root element.
AvatarListFlag	This field, which is only present in the binary representation, signals the presence of the AvatarList element. ”1” means that the element shall be used. ”0” means that the element shall not be used.
VirtualObjectListFlag	This field, which is only present in the binary representation, signals the presence of the VirtualObjectList element. ”1” means that the element shall be used. ”0” means that the element shall not be used.
AvatarList	Optional wrapper element that serves as the placeholder for the list of avatar characteristics information.
VirtualObjectList	Optional wrapper element that serves as the placeholder for the list of virtual object characteristics information.
AvatarListType	Wrapper element type which allows multiple occurrences of avatar characteristics information.
NumAvatarType	This field, which is only present in the binary representation, specifies the number of Avatar information contained in the AvatarListType.
Avatar	Specifies the description of avatar characteristics information.
AvatarBaseType	AvatarBaseType is a type providing a characteristic description of an individual avatar.
IndividualAvatarType	This field, which is only presented in the binary representation, specifies the types of each avatar. *Individual Avatar Type* — *Binary representation for avatar type (8 bits)* AvatarType — 00000000 MakeupAvatarType — 00000001 Reserved — 00000010-11111111
VirtualObjectListType	Wrapper element type which allows multiple occurrences of virtual object characteristics information.
NumVirtualObjectType	This field, which is only present in the binary representation, specifies the number of virtual object information contained in the virtual object list type.
VirtualObject	Specifies the description of virtual object characteristics information.
VirtualObjectBaseType	VirtualObjectBaseType is a type providing a characteristic description of an individual virtual object.
IndividualVirtualObjectType	This field, which is only presented in the binary representation, specifies the types of each virtual object.

	Individual Virtual Object Type	*Binary representation for virtual object type (16 bits)*	
	VirtualObjectType	0000hex	
	Reserved	0001hex-FFFFhex	

4.3.5 Examples

The following shows two use cases of VWOCInfo element, which are for listing avatar characteristics information and for listing virtual object characteristics information.

The first example shows the case when the VWOCInfo is used for AvatarList.

```
<vwoc:VWOCInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2016:01-VWOC-NS
VWOCSchema.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2016:01-VWOC-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004">
    <vwoc:AvatarList>
        <vwoc:Avatar xsi:type="vwoc:AvatarType" id="ID_1" gender="male">
            . . .
        </vwoc:Avatar>
    </vwoc:AvatarList>
</vwoc:VWOCInfo>
```


The second example shows the case when the VWOCInfo is used for VirtualObjectList.

```
<vwoc:VWOCInfo xsi:schemaLocation="urn:mpeg:mpeg-v:2016:01-VWOC-NS
VWOCSchema.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:mpegvct="urn:mpeg:mpeg-v:2012:01-CT-NS" xmlns:vwoc="urn:mpeg:mpeg-
v:2016:01-VWOC-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004">
    <vwoc:VirtualObjectList>
        <vwoc:VirtualObject xsi:type="vwoc:VirtualObjectType" id="ID_80">
            . . .
        </vwoc:VirtualObject>
    </vwoc:VirtualObjectList>
</vwoc:VWOCInfo>
```

Note that these examples are only showing a part of the complete XML description to show the use of the root element, VWOCInfo, with the AvatarList and the VirtualObjectList.

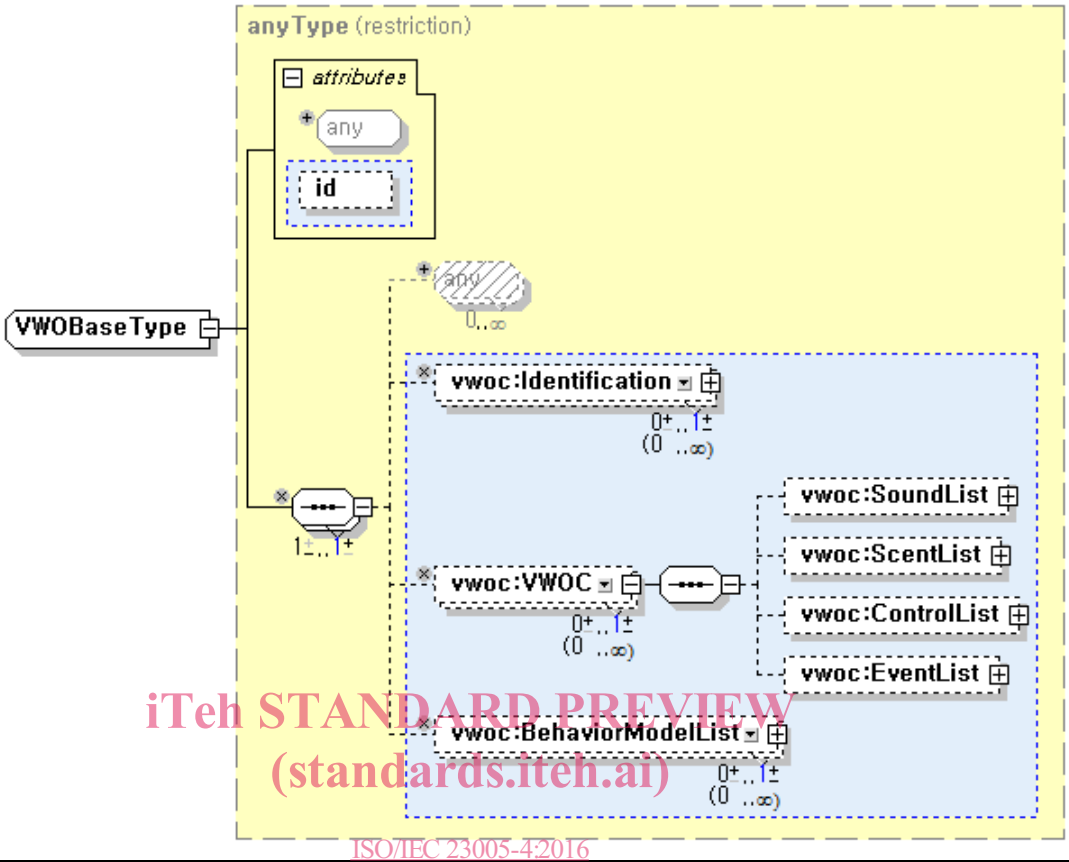
4.4 Virtual world object base type

4.4.1 General

This subclause defines a complex type of VWOBaseType, which the avatar characteristics information and virtual object characteristics information should inherit.

4.4.2 XML representation syntax

Diagram



Source

```
<complexType name="VWOBaseType" abstract="true">
  <complexContent>
    <restriction base="anyType">
      <sequence>
        <element name="Identification" type="vwoc:IdentificationType" minOccurs="0"/>
        <element name="Description" type="string" minOccurs="0"/>
        <element name="VWOC" minOccurs="0">
          <complexType>
            <sequence>
              <element name="SoundList" type="vwoc:VWOSoundListType" minOccurs="0"/>
              <element name="ScentList" type="vwoc:VWOScentListType" minOccurs="0"/>
              <element name="ControlList" type="vwoc:VWOControlListType" minOccurs="0"/>
              <element name="EventList" type="vwoc:VWOEventListType" minOccurs="0"/>
            </sequence>
          </complexType>
        </element>
        <element name="BehaviorModelList" type="vwoc:VWOBehaviorModelListType" minOccurs="0"/>
      </sequence>
      <attribute name="id" type="ID" use="optional"/>
    </restriction>
  </complexContent>
</complexType>

<complexType name="AvatarBaseType" abstract="true">
  <complexContent>
    <extension base="vwoc:VWOBaseType"/>
  </complexContent>
</complexType>

<complexType name="VirtualObjectBaseType" abstract="true">
  <complexContent>
    <extension base="vwoc:VWOBaseType"/>
  </complexContent>
</complexType>
```