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1 Introduction

This document identifies some solutions to the problem stated in the Editor's Note in clause 7.7.1.1 of the MDS Study of CD, document ISO/IEC JTC 1/SC 29/WG 11/N3816. Therefore this document is intended as a contribution to the MDS group.

Presently there is no way to instantiate an Ordering Key DS within a "valid" MPEG-7 description.

To solve this problem three proposals are here considered and their respective implication are discussed. The first proposal is to derive the OrderingKeyType as an extension of the HeaderType allowing the instantiation, at the header level, of any MPEG-7 Complete/Unit Description and DSType instances. The second solution is to include the OrderingKey DS as a component of the BasicDescriptionType. This allows to apply the ordering tool only in an MPEG-7 Complete Description, but no Unit Description. The third solution is to adopt both the first and second proposals. In Section 2 the three solutions are detailed and the required modification in terms of syntax and usage are discussed. In Section 3 the three solutions are compared.

2 OrderingKey DS instantiation

2.1 First solution: to derive the OrderingKeyType from the HeaderType

This solution requires to modify the OrderingKey DS syntax as follows:

```
<!-- ##### -->
<!-- Definition of OrderingKey DS -->
<!-- ##### -->

<complexType name="OrderingKeyType">
  <complexContent>

    <!-- ##### -->
    <!-- Note the change of the base type from DSType to -->
    <!-- HeaderType -->
    <!-- ##### -->

    <extension base="mpeg7:HeaderType">
      <sequence>
        <element name="Selector" type="mpeg7:xPathType"/>
        <element name="Field" type="mpeg7:xPathType"
          minOccurs="1" maxOccurs="unbounded"/>
      </sequence>
      <attribute name="name" type="string" use="optional"/>
      <attribute name="semantics" type="string" use="optional"/>
      <attribute name="direction" use="default"
        value="descending">
        <simpleType>
          <restriction base="string">
            <enumeration value="descending"/>
            <enumeration value="ascending"/>
          </restriction>
        </simpleType>
      </attribute>
    </extension>
  </complexContent>
</complexType>
```

```

        </restriction>
      </simpleType>
    </attribute>
  </extension>
</complexContent>
</complexType>

```

The OrderingKeyType is now derived from the HeaderType instead of the DSType. Note that no changes in semantics are required.

2.1.1 Instantiation examples

Adopting this solution implies that we can instantiate the OrderingKeyDS at the HeaderType level allowing to order all the description components of Complete and Unit descriptions as it is demonstrated in the following examples.

2.1.1.1 OrderingKey usage in a Complete Description

The next example shows how to use the OrderingKey tool to order elements of a ContentDescription instance. The OrderingKey DS allows to order alphabetically the User elements of the Content Description DS.

```

<Mpeg7 xmlns="http://www.mpeg7.org/2001/MPEG-7_Schema"
xml:lang="en"
type="complete">

  <OrderingKey name="UsersOrdering"
    semantics="Alphabetical list of users">
    <Selector>/ContentManagement/User </Selector>
    <Field> Name@FamilyName </Field>
    <Field> Name@GivenName </Field>
  </OrderingKey>

  <ContentManagement xsi:type="UserDescriptionType">
    <User>
      <Name xml:lang="it">
        <GivenName> Riccardo </GivenName>
        <FamilyName> Leonardi </FamilyName>
      </Name>
    </User>
    :
    <User>
      <Name xml:lang="it">
        <GivenName> Nicola </GivenName>
        <FamilyName> Adami </FamilyName>
      </Name>
    </User>
  </ContentManagement>
</Mpeg7>

```

```

</User>
<UserPreferences>
  <OrderingKey name="UsersOrdering"
    semantics="List by preferenceValue">
    <Selector>
      ./UsagePreferences/FilteringAndSearchPreferences/
        ClassificationPreferences
    </Selector>
    <Field> Genre@preferenceValue </Field>
  </OrderingKey>

  <UserIdentifier>
    <UserName> leon </UserName>
  </UserIdentifier>
  <UsagePreferences>
    <FilteringAndSearchPreferences>
      <ClassificationPreferences>
        <Genre
          preferenceValue="-10"><Label>News</Label></Genre>
          :
        <Genre
          preferenceValue="10"><Label>Sports</Label></Genre>
      </ClassificationPreferences>
    </FilteringAndSearchPreferences>
    :
  </UsagePreferences>
</UserPreferences>
</ContentManagement>
</Mpeg7Main>

```

2.1.1.2 OrderingKey usage in a Unit Description

```

<Mpeg7 xmlns="http://www.mpeg7.org/2001/MPEG-7_Schema">
  <DescriptionMetadata>
    <Version>1.0</Version>
    <PrivateIdentifier>myUnitDescription</PrivateIdentifier>
  </DescriptionMetadata>

  <OrderingKey name="ActionOrdering"
    semantics="The shots containing more action">
    <Selector>
      /DescriptionUnit/VideoSegment/SegmentDecomposition/Segment
    </Selector>
    <Field>
      CameraMotion/CameraMotionSegment/FractionalPresence@TRACK_LEFT_F

```

```

</Field>
</OrderingKey>

<DescriptionUnit xsi:type="mpeg7:VideoSegmentType">
  <VideoSegment id="id1">
    <OrderingKey name="Close-up Ordering"
      semantics="The shots containing close-up of a player">
      <Selector>./SegmentDecomposition/Segment</Selector>
      <Field>
        CameraMotion/CameraMotionSegment/FractionalPresence@ZOOM_IN_F
      </Field>
    </OrderingKey>

    <SegmentDecomposition DecompositionType="temporal">
      <Segment xsi:type="mpeg7:VideoSegmentType" id="id2">
        <MediaTime> ... </MediaTime>
        <CameraMotion
          NumSegmentDescription="3" DescriptionMode="1">
          <CameraMotionSegment>
            <FractionalPresence>
              <TRACK_LEFT_F>0.23</TRACK_LEFT_F>
              <ZOOM_IN_F>0.56</ZOOM_IN_F>
            </FractionalPresence>
            <Amount ...> ... </Amount>
          </CameraMotionSegment>
        </CameraMotion>
      </Segment>
      <Segment xsi:type="mpeg7:VideoSegmentType" id="id3">
        <MediaTime> ... </MediaTime>
        <CameraMotion
          NumSegmentDescription="3" DescriptionMode="1">
          <CameraMotionSegment>
            <FractionalPresence>
              <TRACK_LEFT_F>0.1</TRACK_LEFT_F>
              <ZOOM_IN_F>0.8</ZOOM_IN_F>
            </FractionalPresence>
            <Amount ...> ... </Amount>
          </CameraMotionSegment>
        </CameraMotion>
      </Segment>
      <Segment xsi:type="mpeg7:VideoSegmentType" id="id4">
        <MediaTime> ... </MediaTime>
        <CameraMotion
          NumSegmentDescription="3" DescriptionMode="1">
          <CameraMotionSegment>
            <FractionalPresence>
              <TRACK_LEFT_F>0.67</TRACK_LEFT_F>
            </FractionalPresence>
            <Amount ...> ... </Amount>
          </CameraMotionSegment>
        </CameraMotion>
      </Segment>
    </SegmentDecomposition>
  </VideoSegment>
</DescriptionUnit>

```

```

        </CameraMotionSegment>
      </CameraMotion>
    </Segment>
  </SegmentDecomposition>
  <MediaTime> ... </MediaTime>
</VideoSegment>
</DescriptionUnit>
</Mpeg7>

```

2.2 Second solution: let the BasicDescription type contain the OrderingKey DS

It requires to replace the BasicDescription DS syntax in Par. 5.2.1.1 of the MDS CD document ISO/IEC JTC 1/SC 29/WG 11/N3705 with the following one:

```

<!-- ##### -->
<!-- Definition of BasicDescription Type -->
<!-- ##### -->

<complexType name="BasicDescriptionType" abstract="true">
  <sequence>
    <element name="DescriptionMetadata"
      type="mpeg7:DescriptionMetadataType" minOccurs="0"/>
    <element name="Relationships" type="mpeg7:GraphType"
      minOccurs="0" maxOccurs="unbounded"/>

    <!-- ##### -->
    <!-- Note the insertion of the new element "OrderingKey" -->
    <!-- ##### -->

    <element name="OrderingKey" type="mpeg7:OrderingKeyType"
      minOccurs="0" maxOccurs="unbounded"/>
  </sequence>
</complexType>

```

And the BasicDescription DS semantics in Par. 5.2.1.2 of the MDS CD document ISO/IEC JTC1/SC29/WG 11/N3705 with following one:

<i>Name</i>	<i>Definition</i>
BasicDescriptionType	Describes AV content, abstractions of AV content and management of content.
e	BasicDescriptionType provides the base specification for the ContentDescription and ContentManagement top-level types (abstract).

<i>Name</i>	<i>Definition</i>
DescriptionMetadata	Describes the description metadata for the descriptions contained within this top-level element. The description metadata propagates (applies) to the descriptions contained within this top-level element, unless new description metadata is specified for these descriptions.
Relationships	Describes relationships among the DS instances in the description. Also describes relationships across different individual sub-descriptions that appear under a single Mpeg7Main root element.
OrderingKey	Describes an ordering of description tools (or parts of description tools). The OrderingKey DS is a specification of <i>hint</i> that an MPEG-7 application when it is necessary to order instances of MPEG-7 description tools. Note that the ordering defined in the ordering key does not constrain the actual order of appearance within the description itself.

When adopting this solution, the Ordering Key DS can still be derived from the DSType, or from the HeaderType. However, when the Ordering Key DS is derived from the DSType, it doesn't allow the effective ordering of UnitDescription components.

2.2.1 Instantiation examples

Adopting this solution implies that we can instantiate the OrderingKeyDS as element of any type derived from the BasicDescription top-level type.

2.2.1.1 OrderingKey usage in a Complete Description

The next example shows how to use the OrderingKey tool to order elements of a ContentDescription instance as in Examples 2.1.1.1.

```
<Mpeg7 xmlns="http://www.mpeg7.org/2001/MPEG-7_Schema"
xml:lang="en" type="complete">

  <ContentManagement xsi:type="UserDescriptionType">

    <OrderingKey name="UsersOrdering"
      semantics="Alphabetical list of users">
      <Selector>./User </Selector>
      <Field> Name@FamilyName </Field>
      <Field> Name@GivenName </Field>
    </OrderingKey>

    <OrderingKey name="UsersOrdering"
      semantics="List by preferenceValue">
      <Selector>
        ./UserPreferences/UsagePreferences/
        FilteringAndSearchPreferences/ClassificationPreferences
      </Selector>
      <Field> Genre@preferenceValue </Field>
    </OrderingKey>
  </ContentManagement>
</Mpeg7>
```

```

    </OrderingKey>

    <User>
      <Name xml:lang="it">
        <GivenName> Riccardo </GivenName>
        <FamilyName> Leonardi </FamilyName>
      </Name>
    </User>
    :
    <User>
      <Name xml:lang="it">
        <GivenName> Nicola </GivenName>
        <FamilyName> Adami </FamilyName>
      </Name>
    </User>
    <UserPreferences>
      <UserIdentifier>
        <UserName> leon </UserName>
      </UserIdentifier>
      <UsagePreferences>
        <FilteringAndSearchPreferences>
          <ClassificationPreferences>
            <Genre
              preferenceValue="-10"><Label>News</Label></Genre>
            :
            <Genre
              preferenceValue="10"><Label>Sports</Label></Genre>
          </ClassificationPreferences>
        </FilteringAndSearchPreferences>
        :
      </UsagePreferences>
    </UserPreferences>
  </ContentManagement>
</Mpeg7Main>

```

2.2.1.2 OrderingKey usage in a Unit Description

As can be seen in this example the OrderingKey DS can be instantiated but the use is ambiguous because there are two DescriptionUnit of the same type.

```

<Mpeg7 xmlns="http://www.mpeg7.org/2001/MPEG-7_Schema">
  <DescriptionMetadata>
    <Version>1.0</Version>
    <PrivateIdentifier>myUnitDescription</PrivateIdentifier>
  </DescriptionMetadata>

  <DescriptionUnit xsi:type="mpeg7:OrderingKeyType">
    <OrderingKey name="ActionOrdering"
      semantics="The shots containing more action">
      <Selector>

```



```

    /DescriptionUnit/VideoSegment/SegmentDecomposition/Segment
  </Selector>
  <Field>
CameraMotion/CameraMotionSegment/FractionalPresence@TRACK_LEFT_F
  </Field>
  </OrderingKey>
</DescriptionUnit>

<DescriptionUnit xsi:type="mpeg7:VideoSegmentType">
  <VideoSegment id="id1">
    <SegmentDecomposition DecompositionType="temporal">
      <Segment xsi:type="mpeg7:VideoSegmentType" id="id2">
        <MediaTime> ... </MediaTime>
        <CameraMotion
          NumSegmentDescription="3" DescriptionMode="1">
            <CameraMotionSegment>
              <FractionalPresence>
                <TRACK_LEFT_F>0.23</TRACK_LEFT_F>
                <ZOOM_IN_F>0.56</ZOOM_IN_F>
              </FractionalPresence>
              <Amount ...> ... </Amount>
            </CameraMotionSegment>
          </CameraMotion>
        </Segment>
        <Segment xsi:type="mpeg7:VideoSegmentType" id="id3">
          <MediaTime> ... </MediaTime>
          <CameraMotion
            NumSegmentDescription="3" DescriptionMode="1">
              <CameraMotionSegment>
                <FractionalPresence>
                  <TRACK_LEFT_F>0.1</TRACK_LEFT_F>
                  <ZOOM_IN_F>0.8</ZOOM_IN_F>
                </FractionalPresence>
                <Amount ...> ... </Amount>
              </CameraMotionSegment>
            </CameraMotion>
          </Segment>
        <Segment xsi:type="mpeg7:VideoSegmentType" id="id4">
          <MediaTime> ... </MediaTime>
          <CameraMotion
            NumSegmentDescription="3" DescriptionMode="1">
              <CameraMotionSegment>
                <FractionalPresence>
                  <TRACK_LEFT_F>0.67</TRACK_LEFT_F>
                </FractionalPresence>
                <Amount ...> ... </Amount>
              </CameraMotionSegment>
            </CameraMotion>
          </Segment>
        </SegmentDecomposition>
      <MediaTime> ... </MediaTime>
    </VideoSegment>
  </DescriptionUnit>

```

```
</VideoSegment>
</DescriptionUnit>

<DescriptionUnit xsi:type="mpeg7:VideoSegmentType">
  <VideoSegment id="idN">
    :
  </VideoSegment>
</Mpeg7>
```

2.3 Third solution: both 2.1 and 2.2

This solution needs both to derive the OrderingKey DS from the HeaderType and to include it as element of the BasicDescription top-level type. Even if the first solution guarantees the ordering of components in Complete and Unit descriptions, the second one allows to use the OrderingKey DS inside top-level types, derived from the BasicDescriptionType. This allows to incorporate each ordering DS readily where it should be used, making the readability of the definition and/ or instantiation clear to a human reader.

3 Solutions evaluation

Looking at the previous section it is clear that:

1. The first solution allows to order any component of both Complete and Unit Description.
2. The second one allows to order only components of Complete descriptions.
3. The third let the MPEG-7 description code be more encapsulated and so more clear.

Thus we recommend to promote this third implementation.