INTERNATIONAL STANDARD

**ISO/IEC 15938-1**

First edition
2002-07-01

**AMENDMENT 1**
2005-02-15



# Information technology — Multimedia content description interface —

## Part 1: **Systems**

## AMENDMENT 1: Systems extensions

*Technologies de l'information — Interface de description du contenu multimédia —*

*Partie 1: Systèmes*

*AMENDEMENT 1: Extensions des systèmes*

Reference number
ISO/IEC 15938-1:2002/Amd.1:2005(E)

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Published in Switzerland

 

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Amendment 1 to ISO/IEC 15938-1:2002 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

## Introduction

This document specifies the first Amendment to the Systems (MDS) part of ISO/IEC 15938.

Note: this document preserves the sectioning of ISO/IEC 15938-1 Systems. The text and figures given below are additions and/or modifications to those corresponding sections in ISO/IEC 15938-1. All figures and tables shall be renumbered due to the addition of several figures and tables.

# Information technology — Multimedia content description interface —

## Part 1: Systems

## AMENDMENT 1: Systems extensions

*Add the following reference in Clause 2:*

- *RFC 1950, ZLIB Compressed Data Format Specification version 3.3.*

*Add the following definition at the end of subclause 3.1.2.2.5:*

**ReservedBitsZero**: a binary syntax element whose length is indicated in the syntax table. The value of each bit of this element shall be “0”. These bits may be used in the future for ISO/IEC defined extensions.

*Add the following definitions to subclause 3.2 (keep alphabetical order):*

**initial schema**
The schema that is known by the decoder before the decoding process starts.

**additional schema**
A schema that can be updated after the start of the decoding process.

**schema update unit**
Information in an access unit, conveying a schema or a portion thereof. Schema update units provide the means to modify the current decoder schema knowledge.

**description fragment reference**
A reference to a description fragment.

Note - For instance, a fragment reference can be a URI which serves to locate the fragment on the world wide web.

**fragment reference**
short term for description fragment reference.

**fragment reference resolver**
An entity that is capable of resolving the fragment reference provided in the fragment update payload.

**fragment reference marker**
A specific information used to describe a deferred fragment reference, which is present within the current description tree. It consists of a fragment reference, the name and type of the top most element of the referenced fragment.

**fragment reference format**
An encoding format of fragment references.

**deferred fragment reference**
A fragment reference that can be resolved at any time by the application using the terminal.

**non-deferred fragment reference**
A fragment reference that shall be resolved by the terminal at the composition time of the access unit containing the fragment reference.

**optimised decoder**
A decoder associated to a type and dedicated to certain encoding methods better suited than the generic ones.

**type codec**
Synonym to optimised decoder.

**fixed optimised decoder**
An optimised decoder used to decode either a complex type or a simple type. Fixed optimised decoders are set up at decoder initialisation phase and their mapping to types can't be modified during binary description stream lifetime.

**advanced optimised decoder**
An optimised decoder used to decode a simple type. Advanced optimised decoders parameters and their mappings to types can be modified during binary description stream lifetime.

**advanced optimised decoder instance**
An advanced optimised decoder initialised and ready to be used for the decoding of some data types.

Note - There can be several instances of the same advanced optimised decoder with different or identical parameters.

**advanced optimised decoder type**
The type, identified by a URI, of an advanced optimised decoder.

**advanced optimised decoder instances table**
A table of all the advanced optimised decoders available at a certain instant in time.

**contextual optimised decoder**
An optimised decoder which behavior is dependent on the current context of the decoding.

Note - For instance, the ZLib optimised decoder (see Clause 9) is a contextual optimised decoder.

Note - Upon certain events, the context must be reset. Upon a certain command or events they are flushed to release their contents. Only contextual optimised decoders are flushable.

**advanced optimised decoder parameters**
The parameters of an advanced optimised decoder.

**contextual optimised decoder reset**
An operation that resets the optimised decoder to put it in a defined initial state. All contextual information is discarded.

**skippable subtree**
A subtree of an XML document that the decoder is permitted not to decode.

**optimised decoder mapping**
An association between a type and a set of optimised decoders.

*Renumber all definitions in subclause 3.2.*

*Add the following abbreviations to the table in subclause 4.1:*

| | |
|---|---|
| MSB | Most Significant Bit |
| SU | Schema Update |
| SUU | Schema Update Unit |

*Add the following mnemonic to subclause 4.3:*

| *Name* | *Definition* |
|---|---|
| vlurmsbf5 | Variable length code unsigned rational number, most significant bit first. The first n bits (Ext) which are '1' except of the nth bit which is '0', indicate that the rational number R in the interval 0≤R<1 is encoded by n times 4 bits. The ith bit of the n times 4 bits representing the rational number corresponds to a value of 2^-i. Thus the (n+1)st bit of the vlurmsbf5 code word (which corresponds to the MSB of the rational number) represents a value of ½, the (n+2)nd bit of the vlurmsbf5 code word represents a value of ¼., and so forth.<br><br>An example for this type is shown in Figure AMD1-1.<br><br>Note - Comparing two rational numbers A and B represented by a vlurmsbf5 code word can be done by comparing bit by bit the rational numbers starting from their respective MSBs. Then the rational number A is bigger if there is a '1' bit at a position at which there is a '0' for B. A is also bigger if there is a '1' bit at a position which is not present for B and when A is longer than B. |

*In subclause 4.3, add the following figure after Figure 2:*

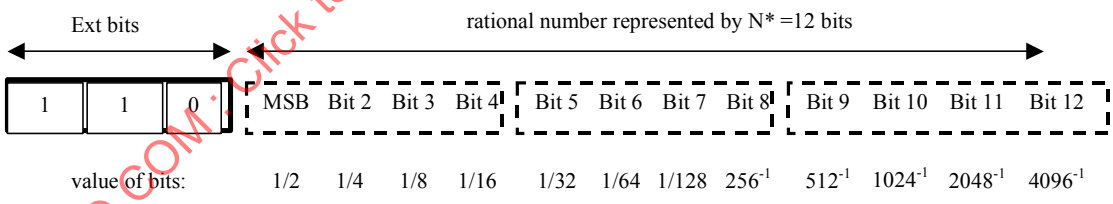



**Figure AMD1-1 - Informative example for the vlurmsbf5 data type**

*Remove the '(informative)' in the title of subclause 5.2.3.*

*In subclause 5.2.3, replace this paragraph:*

The BiM, in order to gain its compression efficiency, relies on a schema analysis phase. During this phase, internal tables are computed to associate binary code to XML elements, types and attributes.This principle mandates the full knowledge of the same schema by the decoder and the encoder for maximum interoperability.

*by*

The BiM, in order to gain its compression efficiency, relies on a schema analysis phase. During this phase, internal tables are computed to associate binary code to schema components (XML elements, types and attributes). BiM defines two methods to address schema components.

The first method allows the decoder to resolve a schema, possibly including schema components originating from several namespaces, at initialization phase. This set of schema components form the *initial schema.* In this schema, all type and substitution codes are merged together no matter the namespace they belong to. This results in shorter codes in the binary description stream. The initial schema can't be updated and is considered fixed for the binary description stream lifetime. It contains by default and at minimal the type codes of the xml schema types: anyType, anySimpleType, and all xml schema simple types. In this specification, anySimpleType is considered as a subtype of anyType.

The second method allows the decoder both to resolve a schema at initialization phase (the *initial schema*) and to receive updated schema information called *additional schemas*. Additional schemas differ from the initial schema as the codes of their schema components defined in different namespaces are defined in different code spaces. This results in larger code size but has the required flexibility for late updating. For full flexibility it is also possible to receive exclusively additional schemas and thus to operate without initial schema.

Both initial schemas and additional schemas are part of a unique table in which each entry identifies a specific schema. The first entries identify schemas that are part of the initial schema. The following ones identify additional schemas.

To further improve compression, BiM allows the association of specific codecs to specific data types instead of using the generic mechanisms defined in Clause 8. These encoding schemes can be optimised with the full knowledge of the properties of that data type.

*In subclause 5.2.3, replace this paragraph:*

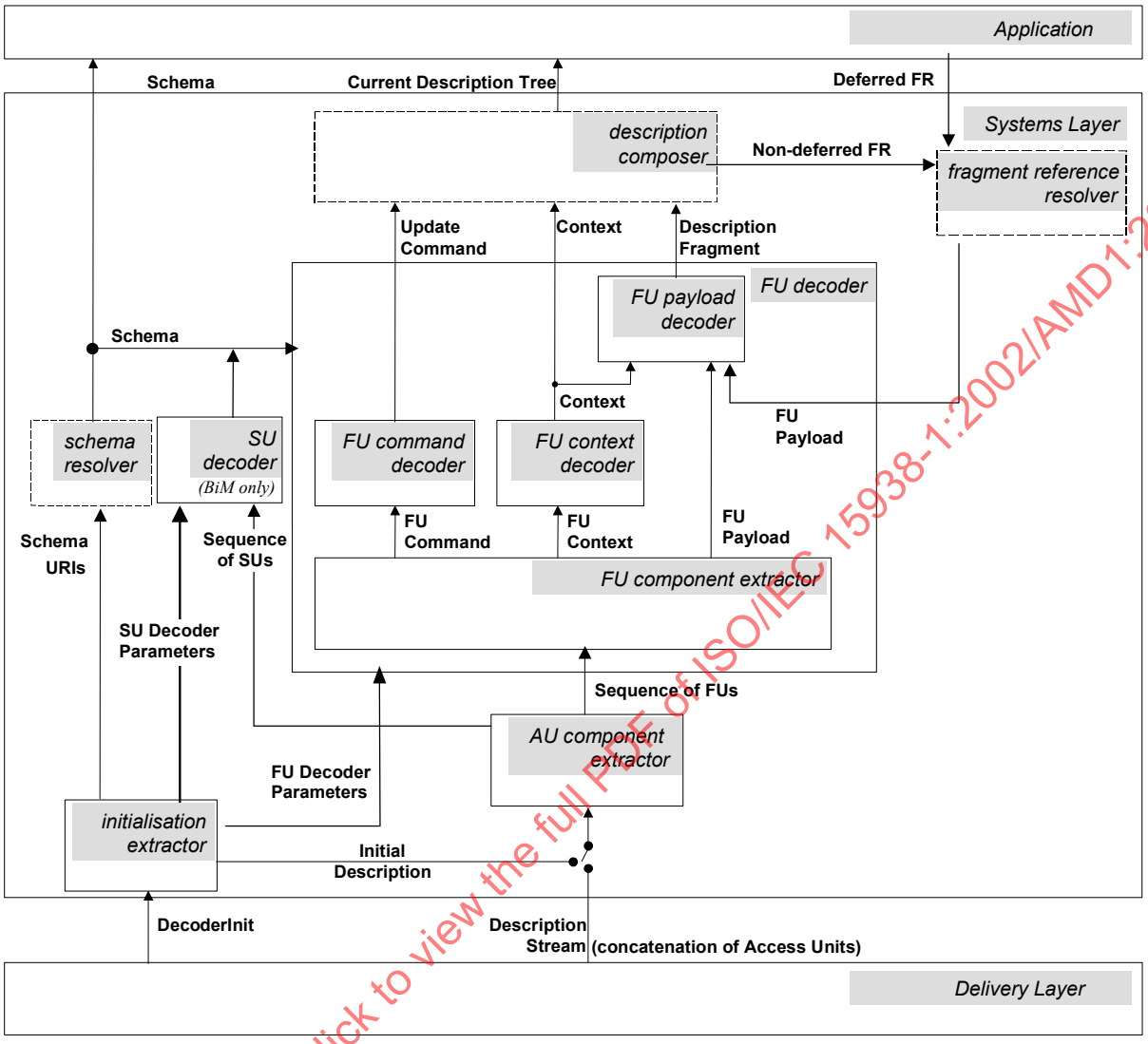
As with the textual decoder, the resulting current description tree may be topologically equivalent to the original description if desired by the encoder, but it may also exhibit dynamic characteristics such that certain parts of the description are present at the decoder only at chosen times, are never present at all, can be acquired on application demand, or appear in a different part of the tree.

*by*

As with the textual decoder, the resulting current description tree may be topologically equivalent to the original description if desired by the encoder, but it may also exhibit dynamic characteristics such that certain parts of the description are present at the decoder only at chosen times, are never present at all, can be acquired on application demand, or appear in a different part of the tree.

Note - The schema update capabilities provided by the BiM framework defined in this specification aims at upgrading BiM decoder. It is not a mean to transmit an XML schema as is. To do so, one should use the W3C schema of schema to encode its schema.

*In subclause 5.3, replace the "Figure 4 - Terminal Architecture" by the following figure:*




*In subclause 5.3, second paragraph, replace:*

…(FU Decoder Parameters, in Figure …

*by*

…(FU Decoder Parameters and SU Decoder Parameters, in Figure …

*In subclause 5.4, add the following text after the first paragraph:*

In the case of BiM, an access unit is composed of any number of schema update units followed by any number of fragment update units which are extracted by the access unit component extractor.

A schema update unit carries parts of an additional schema and is composed of

— a namespace identifier,

— a set of code tables to represent global elements, global types and global attributes,

— a binary encoded schema carrying the schema components definitions.

The full schema is not always necessary for the decoding of a particular binary description stream. To avoid unnecessary transmission, a schema update unit may contain only the definitions that are required for the decoding of the bitstream. In this case the code tables can also be sent partially.

Some further constraints are applied to the acquisition of schema update units, notably to ensure that a decoder will not break in case of a missed schema update unit. A specific schema update unit, the so-called first schema update unit, contains initialization information and shall be acquired by the decoder before any use of a received definition. The decoder behavior in case of such missed schema update units is not normative. A transmitted schema definition shall not change during binary description stream lifetime and there shall not be two schema identifiers associated to the same namespace. Finally, all the optimised decoders associated to existing types are immediately applied to all types they derive from in accordance to the rules defined for the optimized decoders in Clause 9.

Once received by the decoder, a schema update unit immediately updates schema information managed by the decoder. It becomes available for the fragment update unit carried in the same access unit as well as future access units.

*In subclause 5.4, replace this paragraph:*

An access unit is composed of any number of fragment update units, each of which is extracted in sequence by the fragment update component extractor. Each fragment update unit consists of:

*by*

In case of TeM, an access unit is composed of any number of fragment update units.

In both TeM and BiM, fragment update units are extracted in sequence by the fragment update component extractor. Each fragment update unit consists of:

*In subclause 5.4, replace the following paragraph:*

— a fragment update payload conveying the coded description fragment to be added or replaced.

*by*

— a fragment update payload conveying either the coded description fragment (extracted out of the original description) to be added or replaced, or a reference to it.

*In subclause 5.4, replace the following text:*

The corresponding update command and context are processed by the non-normative description composer, which either places the description fragment received from the fragment update payload decoder at the appropriate node of the current description tree at composition time, or sends a reconstruction event containing this information to the application. The actual reconstruction of the current description tree by the description composer is implementation-specific, i.e., the application may direct the description composer to prune or ignore unwanted elements as desired. There is no requirement on the format of this current description tree, e.g. it may remain a binary representation.



*by*

The corresponding update command and context are processed by the non-normative description composer, which either places the description fragment extracted out of the original description or a reference to it received from the fragment update payload decoder at the appropriate node of the current description tree, or sends a reconstruction event containing this information to the application. If the payload consists of a fragment reference, depending on its nature, the referenced fragment is either immediately acquired (non-deferred fragment reference) or its acquisition is left to the application (deferred fragment references). In case of a deferred fragment reference, a fragment reference marker is available to the application to help further acquisition. This marker consists of the fragment reference itself, the name and type of the top most element of the referenced fragment. The fragment reference marker is added to the current description tree at the location defined by the fragment update context.

The actual reconstruction of the current description tree by the description composer is implementation-specific, i.e., the application may direct the description composer to prune or ignore unwanted elements as desired. There is no requirement on the format of this current description tree, e.g., it may remain a binary representation.

*Change the title of subclause 5.5.2 by:*

Deferred nodes, fragment references and their use

*In subclause 5.5.2, add the following sentence at the end of the first paragraph:*

Some deferred nodes are marked with a fragment reference marker that specifies where the fragment can be acquired. It is then left to the application to decide when to acquire it.

*In subclause 5.5.2, replace the following sentence:*

… The deferred nodes may then be replaced in any subsequent access unit without changing the tree topology maintained internally in the decoder. …

*by*

… The deferred nodes may then be replaced in any subsequent access unit or on application demand without changing the tree topology maintained internally in the decoder. …

*In subclause 5.5.3, remove "ISO/IEC 15938" of the second sentence of the first paragraph.*

*In subclause 5.5.3, add the following note at the end of the subclause:*

Note – Forward compatibility can also be used to generate bitstreams that can be decoded even in case of a schema update unit has not been received (for example because an error occurred) or because the decoder is not able to accept schema update units.

*In subclause 5.6.3, replace the following text:*

In the TeM, the commands are AddNode, ReplaceNode, and DeleteNode. The AddNode is effectively an "append" command, adding an element of the target node. Insertion between two already-received,

consecutive children of a node is not possible. One must replace a previously deferred node. By performing a DeleteNode on a node on the current description tree, the addressable indices of its siblings change appropriately.

*by*

In the TeM, the commands are AddNode, ReplaceNode, and DeleteNode. The AddNode is by default an "append" command, adding an element after the last child of the target node. The position of the added element can also be explicitely defined allowing an element for instance to be inserted before the first element or between two other elements. By performing a DeleteNode on a node on the current description tree, the addressable indices of its siblings change appropriately.

*In subclause 5.6.3, replace the following text:*

In the BiM, the commands are AddContent, ReplaceContent and DeleteContent. The AddContent conveys the node data for a node whose path within the description tree is predetermined from the schema evaluation as described in . Hence, internally to the BiM decoder, the paths to (or addresses of) non-empty sibling nodes may be non-contiguous, e.g., the second and fourth occurrence of an element may be present. The "hole" in the numbering is not visible in the current description tree generated by the description composer. Hence, if the third occurrence of said element is added (using AddContent) in a subsequent access unit, it appears to any further processing steps as an "inserted" element in the current description tree, while it simply fills the existing "hole" with respect to the internal numbering of the BiM decoder.

*by*

In the BiM, the commands are AddContent, ReplaceContent and DeleteContent. The AddContent conveys the node data for a node whose path within the description tree is predetermined from the schema evaluation as described in 5.6.2. The insertion point for the node data is indicated using so called position codes. BiM supports 2 mechanisms for representing these position codes: integer or rational numbers. The first method (integer numbers) requires that "holes" must be left to enable the insertion of new node data. Thus documents to be sent must be known in advance or some contingency holes must be allocated. Hence, if the third occurrence of said element is added (using AddContent) in a subsequent access unit, it appears to any further processing steps as an "inserted" element in the current description tree, while it simply fills the existing "hole" with respect to the internal numbering of the BiM decoder. The "hole" in the numbering is not visible in the current description tree generated by the description composer. However, it is not always possible to know in advance the number of nodes to be added and where within the description tree they are to be added. The second method (rational numbers) removes this limitation by enabling the insertion of new node data at any location within the current binary description tree. A single method shall be used for representing position codes within a given stream. This is signalled within the decoderInit.

*In subclause 5.6.4, replace the following text:*

Wildcards and mixed content models (defined in ISO/IEC 15938-2) are not supported at all by the BiM. Therefore a schema that uses these mechanisms cannot be supported by the binary format.

*by*

Wildcards (defined in ISO/IEC 15938-2) are supported by the BiM, only in the case the schema of the elements or attributes validated by the wildcard is known by the decoder (i.e. it is in the initial schema or in one of the additional schemas acquired by the decoder).

The BiM encodes only the canonical form of XML documents. Therefore comments as well as namespace prefixes are lost in the encoding process.

*Add the following subclause (subclause 5.8):*

## 5.8 Decoding of Fragment References

### 5.8.1 Decoding of Non-Deferred Fragment References

The result of decoding a non-deferred fragment reference shall be, passed to a mechanism (fragment reference resolver) which returns fragment update payload data to the FU payload decoder. This fragment update payload data may be in one of two forms:

— a TeM fragment update payload containing the description fragment data in case of a TeM bitstream;

— a BiM fragment update payload containing the description fragment data in case of a BiM bitstream.

Note - Examples of possible fragment resolver are:
- An HTTP communication session to a WEB server
- A DSM-CC Object carousel

### 5.8.2 Decoding of Deferred Fragment References

The result of decoding a deferred fragment reference shall be a fragment reference marker which consists of a fragment reference, the name and type of its top most element.

Note - This fragment reference marker is signalled to the application and can be used to acquire the fragment through the fragment reference resolver at any instant of the description stream.

*In subclause 6.1, replace the following text:*

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"
       xmlns:mpeg7s="urn:mpeg:mpeg7:systems:2001"
       targetNamespace="urn:mpeg:mpeg7:systems:2001"
       elementFormDefault="qualified"
       attributeFormDefault="unqualified">

       <!-- here clause 6 schema definition -->

</schema>
```

*by*

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"

       xmlns:mpeg7s="urn:mpeg:mpeg7:systems:amd1:2004"
       targetNamespace="urn:mpeg:mpeg7:systems:amd1:2004"
       elementFormDefault="qualified"
       attributeFormDefault="unqualified">

       <!-- here clause 6 schema definition -->

</schema>
```

*In subclause 6.5.2, replace the add command definition by:*

| | |
|---|---|
| addNode | Adds the node conveyed within the `FUPayload` to the context node or the parent node of the context node according to the value of the position attribute of the FUContext. If the position is set to the value “lastChild”, the node conveyed within the FUPayload shall be added to the context node as the last child of the context node, or if the position attribute is set to the value “prevSibling”, the node conveyed within the FUPayload shall be added to the parent node of the context node as the previous sibling of the context node. |

*In subclause 6.6.1, rename the “`FUContextType`” in the DDL definition to “`FragmentUpdateContextTypeBase`”.*

*In subclause 6.6.1, add the following DDL definition:*

```
<complexType name="FragmentUpdateContextType">
   <simpleContent>
      <extension base="mpeg7s:FragmentUpdateContextTypeBase">
         <attribute name="position" default="lastChild">
            <simpleType>
               <restriction base="string">
                  <enumeration value="lastChild"/>
                  <enumeration value="prevSibling"/>
               </restriction>
            </simpleType>
         </attribute>
      </extension>
   </simpleContent>
</complexType>
```

*In subclause 6.6.2, add the following semantics:*

| | |
|---|---|
| position | This attribute shall be only present when the FUCommand takes the value “addNode”, and indicates the position of the node added by the “addNode” command against the context node specified by the navigation path. This attribute can have the following values:<br><br>— “lastChild” : the last child of the context node.<br><br>— “prevSibling” : the previous sibling of the context node. |

*In subclause 6.7.1, replace the following text:*

```
<complexType name="FragmentUpdatePayloadType">
   <sequence>
      <any processContents="skip" minOccurs="0"/>
   </sequence>

   <attribute name="hasDeferredNodes" type="boolean"
              use="required" default="false"/>
   <anyAttribute namespace="##other" processContents="skip" use="optional"/>
</complexType>
```

*by*

```
<complexType name="FragmentUpdatePayloadType">
     <sequence>
        <any namespace="##other" processContents="skip" minOccurs="0"/>
        <element name="FragmentReference" type="mpeg7s:FragmentReferenceType"
                  minOccurs="0" />
     </sequence>

     <attribute name="hasDeferredNodes" type="boolean"
                use="required" default="false"/>
     <anyAttribute namespace="##other" processContents="skip" use="optional"/>
</complexType>
```

*In subclause 6.7.2, add the following semantics:*

| | |
|---|---|
| FragmentReference | Defines that the current fragment update payload carries a fragment reference instead of a complete fragment. This element shall not be present if fragment payload actually contains a fragment. The element name and type of the top most element of the fragment being referenced shall be carried before the fragment reference itself. |

*Add the following subclause (subclause 6.8):*

## 6.8 Textual Fragment Reference

### 6.8.1 Syntax

```
<!-- ################################################ -->
<!--  Definition of FragmentReferenceType           -->
<!-- ################################################ -->

<complexType name="FragmentReferenceType" abstract="true">
   <attribute name="isDeferred" type="boolean" use="optional" default="false"/>
</complexType>

<complexType name="URIFragmentReferenceType" >
   <complexContent>
      <extension base="mpeg7s:FragmentReferenceType">
         <attribute name="href" type="anyURI" use="required" />
      </extension>
   <complexContent>
</complexType>
```

### 6.8.2 Semantics

The `FragmentReferenceType` is an abstract complex type which serves as a base type for specific implementation of a fragment reference. The `URIFragmentReferenceType` is a concrete complexType which defines fragment references as a URI.

| *Name* | *Definition* |
|---|---|
| isDeferred | Defines the deferred nature of the fragment reference:<br>— If the `isDeferred` attribute has a value of true, the fragment reference is deferred and shall be resolved as defined in subclause 5.8.2.<br>— If the `isDeferred` attribute has value of false, the fragment reference is non-deferred and shall be resolved as defined in subclause 5.8.1. |
| href | Defines the URI of a fragment refererence of type `URIFragmentReferenceType`. |

### 6.8.3 Examples

In the following, example of the instances of the FUPayload datatype using the fragment reference is shown:

```
<FUPayload>
   <mpeg7:VisualDescriptor xsi:type="mpeg7:ScalableColorType"/>
   <FragmentReference xsi:type="mpeg7s:URIFragmentReferenceType"
      isDeferred="true"
      href="http://aaa.bbb/ccc.xml"/>
</FUPayload>
```

*In subclause 7.1, add the following text and figure at the end of the subclause:*

**Identifying schema components in the BiM framework**

As described in Clause 5, BiM relies upon schema knowledge. In this specification, schema components (elements, types and attributes) are identified by both a *schema identifier* and a *component identifier*.

The decoder manages both a unique initial schema and several additional schemas. From the decoder point of view, both initial schemas and additional schemas are indentified through a unique table in which each entry identifies a specific schema: the first '`NumberOfSchemas`' entries identify schemas that are part of the initial schema. The following ones identify additional schemas (starting at the '`NumberOfSchemas`' entry and ending at the '`NumberOfSchemas + NumberOfAdditionalSchemas - 1`').

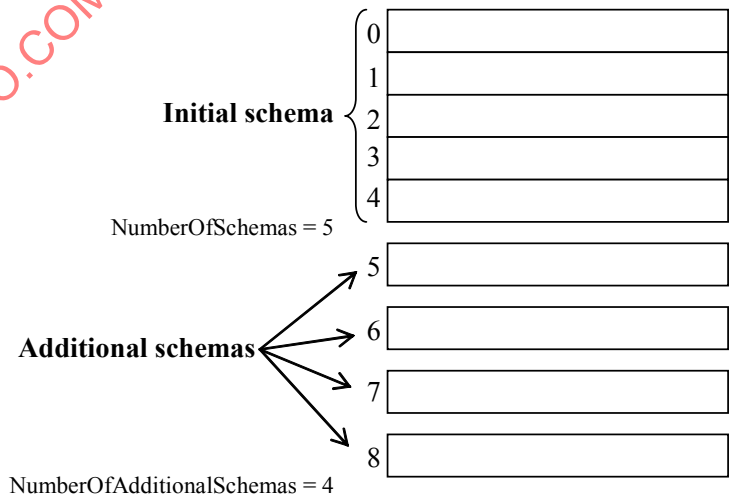



**Figure AMD1-2 - Addressing the initial schema and the additional schemas**

The schema component codes (type codes, element codes or attribute codes) are accessible through all these schemas. However codes are constructed differently depending on which schema they are defined. The initial schema aggregates all schema components possibly coming from different namespaces in a single code space. On the contrary, additional schemas contains only schema components which are defined in their namespace.

*In subclause 7.2.1, replace the following text:*

An optimised type codec specifies an encoding for a data type not using the generic mechanism specified in Clause 8 but optimised with full knowledge of the properties of that data type. Some optimised type codecs are specified in Part 3 of this specification.

*by*

An optimised type codec specifies an encoding for a data type not using the generic mechanism specified in Clause 8 but optimised with full knowledge of the properties of that data type. There are two kinds of optimised type codec (or optimised decoders). A fixed optimised decoder associates a specific encoding scheme to a type of the schema (complex as well as simple) and this association is fixed for the entire stream. An advanced optimised decoder associates a specific encoding scheme to any simple type and this association can be changed during the transmission of the bitstream. Moreover, several advanced optimised decoders can be associated to a single type and can accept parameters. Some fixed optimised type codecs are specified in Part 3 of the specification. Some advanced optimised decoders are defined in Clause 9.

*In subclause 7.2.1, add the following text at the end of the subclause:*

Several other coding modes are initialised in the `DecoderInit` related to the features used by the binary description stream: the insertion of elements, the transmission of schema information and references to fragments.

Transmission of additional schema is specified for two different use cases: The retrieval of schema information in binary format from a location indicated by a URI, the transmission of schema information in a binary description stream jointly or not with the transmission of a description. In the latter case there is a requirement that all schema information needed for the decoding of a fragment of the transmitted description must have been received before such fragment arrives.

*Replace subclause 7.2.2 content by:*

| DecoderInit () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **SystemsProfileLevelIndication** | 8+ | vluimsbf8 |
| **UnitSizeCode** | 3 | bslbf |
| **NoAdvancedFeatures** | 1 | bslbf |
| **ReservedBits** | 4 | bslbf |
| If (! NoAdvancedFeatures) { | | |
| **AdvancedFeatureFlags_Length** | 8+ | vluimsbf8 |
| /** FeatureFlags **/ | | |
| **InsertFlag** | 1 | bslbf |
| **AdvancedOptimisedDecodersFlag** | 1 | bslbf |
| **AdditionalSchemaFlag** | 1 | bslbf |

| | | |
|---|---|---|
| **AdditionalSchemaUpdatesOnlyFlag** | 1 | bslbf |
| **FragmentReferenceFlag** | 1 | bslbf |
| **MPCOnlyFlag** | 1 | bslbf |
| **HierarchyBasedSubstitutionCodingFlag** | 1 | bslbf |
| **ReservedBitsZero** | FeatureFlags_Length*8-6 | bslbf |
| /** FeatureFlags end **/ | | |
| } | | |
| /** Start FUUConfig **/ | | |
| If(! AdditionalSchemaUpdatesOnlyFlag) { | | |
| **NumberOfSchemas** | 8+ | vluimsbf8 |
| for (k=0; k< NumberOfSchemas; k++) { | | |
| **SchemaURI_Length[k]** | 8+ | vluimsbf8 |
| **SchemaURI[k]** | 8* SchemaURI_Length[k] | bslbf |
| **LocationHint_Length[k]** | 8+ | vluimsbf8 |
| **LocationHint[k]** | 8* LocationHint_Length[k] | bslbf |
| **NumberOfTypeCodecs[k]** | 8+ | vluimsbf8 |
| for (i=0; i< NumberOfTypeCodecs[k]; i++) { | | |
| **TypeCodecURI_Length[k][i]** | 8+ | vluimsbf8 |
| **TypeCodecURI[k][i]** | 8* TypeCodecURI_Length[k][i] | bslbf |
| **NumberOfTypes[k][i]** | 8+ | vluimsbf8 |
| for (j=0; j< NumberOfTypes[k][i]; j++) { | | |
| **TypeIdentificationCode[k][i][j]** | 8+ | vluimsbf8 |
| } | | |
| } | | |
| } | | |
| /** FUUConfig - Advanced optimised decoder framework **/ | | |
| If (AdvancedOptimisedDecodersFlag) { | | |
| **NumOfAdvancedOptimisedDecoderTypes** | 8+ | vluimsbf8 |
| for (i=0; i< NumOfAdvancedOptimisedDecoderTypes; i++) { | | |
| **AdvancedOptimisedDecoderTypeURI_Length[i]** | 8+ | vluimsbf8 |
| **AdvancedOptimisedDecoderTypeURI[i]** | 8* AdvancedOptimisedDecoderTypeURI_Length[i] | bslbf |
| } | | |
| AdvancedOptimisedDecodersConfig () | | |
| } | | |

| | | |
|---|---|---|
| /** FUUConfig - Fragment reference framework **/ | | |
| If (FragmentReferenceFlag) { | | |
| **NumOfSupportedFragmentReferenceFormat** | 8 | uimsbf |
| for (i=0;i< NumOfSupportedFragmentReferenceFormat;i++) { | | |
| **SupportedFragmentReferenceFormat[i]** | 8 | blsbf |
| } | | |
| } | | |
| } | | |
| /** end FUUConfig **/ | | |
| If (AdditionalSchemaFlag) { | | |
| AdditionalSchemaConfig () | | |
| } | | |
| /** Initial description **/ | | |
| If (!AdditionalSchemaUpdateOnlyFlag) { | | |
| **InitialDescription_Length** | 8+ | vluimsbf8 |
| InitialDescription() | | |
| } | | |
| **}** | | |

*In subclause 7.2.3, add the following semantics after the sematics of the* `UnitSizeCode` *syntax element:*

| | |
|---|---|
| NoAdvancedFeatures | Signals that none of the following advanced features is used in the binary stream:<br>— dynamic insertions of child elements in the binary current description tree;<br>— advanced optimised decoders;<br>— schema transmission;<br>— fragment references;<br>— position codes only based on MPC. |
| AdvancedFeatureFlags_Length | Defines the number of bytes used for the indication of the advanced features.<br>Note – This length provides a simple framework for future extensions. |
| InsertFlag | Signals that the insertion of child elements in the binary description tree at specific positions is performed by the use of rationale position code as described in subclause 7.6.5.5. |
| AdvancedOptimisedDecodersFlag | Signals that advanced optimised decoders are supported as described in Clause 9. |
| AdditionalSchemaFlag | Signals that additional schemas are supported. |

| | |
|---|---|
| AdditionalSchemaUpdatesOnlyFlag | Signals that the description stream contains only additional schema updates i.e. no fragment update units. The `AdditionalSchemaFlag` shall be set to true when this flag is set to true. |
| FragmentReferenceFlag | Signals that fragment references are supported. |
| MPCOnlyFlag | Signals that position codes in the fragment update context are encoded in MPC mode only. |
| HierarchyBasedSubstitutionCodingFlag | Signals that element substitution codes are computed taking into account their substitution hierachy. If additional schemas are supported (i.e. `AdditionalSchemaFlag`==true) this flag shall be set to true. |

*In subclause 7.2.3, replace the "NumberOfSchemas" semantics by:*

| | |
|---|---|
| NumberOfSchemas | Indicates the number of schemas on which the description stream is based. These schemas compose the initial schema. A zero-value is forbidden. |

*In subclause 7.2.3, add the following semantics after the sematics of the `TypeIdentificationCode` syntax element*

| | |
|---|---|
| NumOfAdvancedOptimisedDecoderTypes | Defines the number of advanced optimised decoder types that are necessary to properly decode the binary description stream. |
| AdvancedOptimisedDecoderTypeURI_Length[i] | Indicates the size in bytes of the `AdvancedOptimisedDecoderTypeURI[i]` syntax element. |
| AdvancedOptimisedDecoderTypeURI[i] | Defines the UTF-8 representation of the URI referencing the advanced optimised decoder type with index i. |
| AdvancedOptimisedDecodersConfig() | See subclause 9.2. |
| NumOfSupportedFragmentReferenceFormat | Specifies the number of fragment reference format that shall be supported by the decoder. |
| SupportedFragmentReferenceFormat[i] | Specifies the $i^{th}$ fragment reference format, according to Table AMD1-1, that shall be supported by the decoder. The `SupportedFragmentReferenceFormat[0]` indicates the default fragment reference format. |
| AdditionalSchemaConfig() | See subclause 7.2.4. |

*In subclause 7.2.3, add the following table:*

**Table AMD1-1 - Fragment Reference Formats**

| ***Fragment Reference Type*** | ***Fragment Reference Format*** | ***Description*** |
|---|---|---|
| 0 | | ISO reserved |
| 1 | URIFragmentReference | This fragment reference format should be used where the reference can be expressed as a URI. |
| 2 - 224 | | ISO reserved |
| 225 – 255 | | Private Use |

*Add the following subclause (subclause 7.2.4):*

### 7.2.4 Syntax of AdditionalSchemaConfig

| AdditionalSchemaConfig () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **NumberOfAdditionalSchemas** | 8+ | vluimsbf8 |
| **NumberOfKnownAdditionalSchemas** | 8+ | vluimsbf8 |
| for (int t=0;t<NumberOfKnownAdditionalSchemas;t++){ | | |
| **KnownAdditionalSchemaID** | 8+ | |
| **AdditionalSchemaURI_Length[KnownAdditionalSchemaID]** | 8+ | vluimsbf8 |
| **AdditionalSchemaURI[KnownAdditionalSchemaID]** | 8* AdditionalSchemaURI_Length [KnownAdditionalSchemaID] | bslbf |
| **BinaryLocationHint_Length[KnownAdditionalSchemaID]** | 8+ | vluimsbf8 |
| **BinaryLocationHint[KnownAdditionalSchemaID]** | 8*BinaryLocationHint_Length[KnownAdditionalSchemaID] | bslbf |
| **NumberOfTypeCodecs[KnownAdditionalSchemaID]** | 8+ | vluimsbf8 |
| for (i=0; i< NumberOfTypeCodecs[KnownAdditionalSchemaID]; i++) { | | |
| **TypeCodecURI_Length[KnownAdditionalSchemaID][i]** | 8+ | vluimsbf8 |
| **TypeCodecURI[KnownAdditionalSchemaID][i]** | 8* TypeCodecURI_Length[KnownAdditionalSchemaID][i] | bslbf |
| **NumberOfTypes[KnownAdditionalSchemaID][i]** | 8+ | vluimsbf8 |
| for (j=0; j< NumberOfTypes[KnownAdditionalSchemaID][i]; j++) { | | |
| **TypeIdentificationCode[KnownAdditionalSchemaID][i][j]** | 8+ | vluimsbf8 |
| } | | |
| } | | |

| | | |
|---|---|---|
| } | | |
| **SchemaEncodingMethod** | 8 | blsbf |
| ExternallyCastableTypeTable(InitialSchema) | | |
| ExternallySubstitutableElementTable(InitialSchema) | | |
| **ReservedBitsZero** | 7 | blsbf |
| } | | |

*Add the following subclause (subclause 7.2.5):*

### 7.2.5 Semantics of AdditionalSchemaConfig

| *Name* | *Definition* |
|---|---|
| NumberOfAdditionalSchemas | Indicates the number of schemas that can be transmitted and that are not declared in the list of `schemaURI`. If additional schemas are not supported, this value is set to zero. |
| NumberOfKnownAdditionalSchemas | Indicates the number of additional schemas that are known to be updated in the bitstream. |
| KnownAdditionalSchemaID | Identifies a schema known to be updated in the bistream. This identifier shall only address an additional schema i.e. its value shall be superior to '`NumberOfSchemas-1`' |
| AdditionalSchemaURI_Length[KnownAdditionalSchemaID] | Indicates the size in bytes of the `AdditionalSchemaURI[KnownAdditionalSchemaID]` length. A value of zero is forbidden. |
| AdditionalSchemaURI[KnownAdditionalSchemaID] | Indicates the UTF-8 representation of the URI of the additional schema identified by `KnownAdditionalSchemaID`.<br><br>Note – This field allows to identify some of the additional schemas that are expected to be updated. This information allows one decoder not to monitor the schema updates for which it already knows the schema. |
| BinaryLocationHint_Length[KnownAdditionalSchemaID] | Indicates the size in bytes of the `BinaryLocationHint_Length[KnownAdditionalSchemaID]`. A value of zero indicates that for the schema that is referenced by the index `KnownAdditionalSchemaID` there is no binary encoded schema available. |
| BinaryLocationHint[KnownAdditionalSchemaID] | This is the UTF-8 representation of the URI to unambiguously reference the location of the binary encoded schema that is referenced by the index `KnownAdditionalSchemaID`.<br><br>The schema can be fetched by the schema resolver and is then received as a description stream composed only of schema update units i.e. for which the `SchemaOnlyFlag` is set to true. |
| NumberOfTypeCodecs[KnownAdditionalSchemaID] | see `NumberOfTypeCodecs[k]` in 7.2.3. |

| | |
|---|---|
| TypeCodecURI_Length[KnownAdditionalSchemaID] | see `TypeCodecURI_Length[k]` in 7.2.3. |
| TypeCodecURI[KnownAdditionalSchemaID][i] | see `TypeCodecURI[k][i]` in 7.2.3. |
| NumberOfTypes[KnownAdditionalSchemaID][i] | see `NumberOfTypes[k][i]` in 7.2.3. |
| TypeIdentificationCode[KnownAdditionalSchemaID][i][j] | see `TypeIdentificationCode[k][i][j]` in 7.2.3. |
| SchemaEncodingMethod | Indicates the encoding method of the schema update units. |
| ExternalCastableTypeTable | Defines the types of the initial schema that are externally castable as defined in subclause 7.7.5.4 and 7.7.5.5. |
| ExternalSubstitutableElementTable | Defines the elements of the initial schema that are substitutable as defined in subclause 7.7.6.4 and 7.7.6.5. |

**Table AMD1-2 - Schema encoding method**

| ***SchemaEncodingMethod*** | ***definition*** |
|---|---|
| 0 | ISO reserved |
| 1 | BiM encoded schema as described in subclause 7.7.8 |
| 2-224 | ISO reserved |
| 225-255 | Private use |

*In subclause 7.3.2, replace the* `AccessUnit` *syntax by:*

| AccessUnit () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| If (AdditionalSchemaFlag) { | | |
| **NumberOfSUU** | 8+ | vluimsbf8 |
| for (i=0; i< NumberOfSUU ; i++) { | | |
| SchemaUpdateUnit() | | |
| } | | |
| } | | |
| If( ! AdditionalSchemaUpdateOnlyFlag) { | | |
| **NumberOfFUU** | 8+ | vluimsbf8 |
| for (i=0; i< NumberOfFUU ; i++) { | | |
| FragmentUpdateUnit() | | |
| } | | |
| } | | |
| } | | |

*In subclause 7.3.3, replace the semantics table by:*

| *Name* | *Definition* |
|---|---|
| NumberOfSUU | Indicates the number of schema update units in this access unit. Value '0' signifies that no schema update unit is carried. |
| NumberOfFUU | Indicates the number of fragment update units in this access unit. Value '0' signifies that no fragment update unit is carried. |

*In subclause 7.4.2, insert the following syntax elements, between the* `FUU_Length` *and the* `FragmentUpdateCommand` *syntax elements:*

| | | |
|---|---|---|
| If (AdvancedOptimisedDecodersFlag){ | | |
| **OptimisedDecoderReparameterization** | 2 | bslbf |
| if (OptimisedDecoderReparameterization == '00') { | | |
| AdvancedOptimisedDecodersConfig () | | |
| } | | |
| } | | |

*In subclause 7.4.3, insert the following semantics, between the* `FUU_Length` *and the* `FragmentUpdateCommand` *semantics:*

| | |
|---|---|
| OptimisedDecodersReparameterization | This 2-bit flag signals if the parameters of the optimised decoders shall be updated. It can take the following values:<br>— '00' – the optimised decoder instance table and mappings shall be redefined;<br>— '01' – the optimised decoder instance table and mappings shall not be redefined;<br>— '10' – the optimised decoder instance table and mappings are reset to the default table and mappings defined in the `DecoderInit`;<br>— '11' – reserved. |
| AdvancedOptimisedDecodersConfig() | See subclause 9.2. |

*In subclause 7.6.1, replace the following text:*

There are two different TBC tables associated to each complexType: The ContextTBC table contains only references to the child elements of complexType and additionally one code word to signal the termination of the path (Path Termination Code). The ContextTBC table contains also one TBC to refer to the parent node. It allows relative navigation within the binary format description tree and move upwards to the parent node. The OperandTBC table additionally contains also the references to the attributes and either to the elements of simpleType or to a simple content, but does not contain the Path Termination Code nor the reference to the parent node. Furthermore, in the OperandTBC table one TBC is reserved for User Data Extension as defined in section 7.6.5.2. Example TBC tables are shown in Table 4 and Table 5.

*by*

There are two different TBC tables associated to each complexType: The ContextTBC table contains only references to the child elements of complexType and additionally one code word to signal the termination of the path (Path Termination Code). The ContextTBC table contains also one TBC to refer to the parent node. It allows relative navigation within the binary format description tree and move upwards to the parent node. The OperandTBC table additionally contains also the references to the attributes and either to the elements of simpleType or to a simple content, but does not contain the Path Termination Code nor the reference to the parent node. Furthermore, in the OperandTBC table one TBC is reserved for User Data Extension as defined in subclause 7.6.5.2. In case of a mixed content model the OperandTBC table also contains a reference to the character data that may appear between the elements. Example TBC tables are shown in Table 4 and Table 5.

*Add the following sentence before the Table "Example of a Context TBC Table":*

In this example the content model of the complex type definition is not 'mixed'.

*In subclause 7.6.2, replace the* `SchemaID` *syntax element in the* `FragmentUpdateContext` *syntax table:*

| | | |
|---|---|---|
| **SchemaID** | ceil( log2( `NumberOfSchemas` + `NumberOfAdditionalSchemas`) ) | uimsbf |

*In subclause 7.6.2, replace the* `ContextPath` *syntax table by:*

| ContextPath () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| TBC_Counter = 0 | | |
| NumberOfFragmentPayloads = 1 | | |
| do { | | |
| if ( ( ContextModeCode == '001' \|\| ContextModeCode == '011' ) && TBC_Counter ==0 ) { *<br>/* absolute addressing mode and first TBC of the context path */* | | |
| If (AdditionalSchemaFlag) { | | |
| **SchemaIDOfSBC_Context_Selector** | ceil( log2( `NumberOfSchemas` + `NumberOfAdditionalSchemas`) ) | uimsbf |
| **Extended_SBC_Context_Selector** | ceil( log2( number_of_global elements in `SchemaIDOfSBC_Context_Selector`)) | bslbf |
| } else { | | |
| **SBC_Context_Selector** | ceil( log2( number of global elements +1)) | bslbf |
| } | | |
| PathTypeCode() | | |

| | | |
|---|---|---|
| } | | |
| else { | | |
| **SBC_Context** | ceil( log2( number of child elements of complexType + 2)) | bslbf |
| If (SBC_Context == “SBC_any”) { | | |
| AnyElementDecoding () | | |
| } else { | | |
| SubstitutionCode() | | |
| } | | |
| PathTypeCode() | | |
| } | | |
| TBC_Counter ++ | | |
| } while ( (SBC_Context_Selector != “Path Termination Code”) && (SBC_Context != “Path Termination Code”)) | | |
| if (SBC_Context_Selector == “Path Termination Code”) ){ | | |
| If (AdditionalSchemaFlag) { | | |
| SchemaIDOfSBC_Operand_Selector | ceil( log2( `NumberOfSchemas` + `NumberOfAdditionalSchemas`) ) | uimsbf |
| Extended_SBC_Operand_Selector | ceil( log2( number_of_global elements in `SchemaIDOfSBC_Operand_Selector`)) | bslbf |
| } else { | | |
| **SBC_Operand_Selector** | ceil( log2( number of global elements )) | bslbf |
| } | | |
| PathTypeCode() | | |
| } | | |
| else { | | |
| **SBC_Operand** | ceil( log2( number of child elements + number of attributes + has_simpleContent + 1)) | bslbf |
| if (SBC_Operand == “SBC_anyAttribute”) { | | |
| SingleAnyAttributeDecoding() | | |
| } | | |
| if (SBC_Operand == “SBC_any”) { | | |
| AnyElementDecoding() | | |
| } | | |
| SubstitutionCode() | | |
| PathTypeCode() | | |
| } | | |

| | | |
|---|---|---|
| TBC_Counter ++ | | |
| for (i=0; i < TBC_Counter; i++) { | | |
| PositionCode() | | |
| } | | |
| if ((ContextModeCode == '011') ||<br>(ContextModeCode == '100')) {<br>*/* multiple fragment update payload mode*/* | | |
| do { | | |
| **IncrementalPositionCode** | ceil( log2( NumberOfMultiOccurrenceLayer+2)) | bslbf |
| if (IncrementalPositionCode != "Skip_Indication") { | | |
| NumberOfFragmentPayloads++ | | |
| } | | |
| else { | | |
| **IncrementalPositionCode**<br>*/* indicating the skipped position */* | ceil ( log2( `NumberOfMultiOccurrenceLayer`+2 )) | bslbf |
| } | | |
| } while (IncrementalPositionCode != "IncrementalPositionCodeTermination") | | |
| NumberOfFragmentPayloads--<br>*/* there is no fragment update payload corresponding to the IncrementalPositionCodeTermination */* | | |
| } | | |
| } | | |

*In subclause 7.6.3, in the first table, replace the* `SchemaID` *semantics by:*

| | |
|---|---|
| SchemaID | Identifies the schema (from the list of `schemaURI`s transmitted in the `DecoderInit` (optionally extended by a list of additional schemas) which is used as basis for the fragment update context coding. The `SchemaID` code word is built by sequentially addressing the list of `SchemaURI` contained in the `DecoderInit` (optionally followed by the additional schemas). The length of this field is determined by: "ceil( log2( `NumberOfSchemas`))" or "ceil( log2( `NumberOfSchemas` + `NumberOfAdditionalSchemas`))" depending on the presence of additional schemas.<br><br>The value of this code word is the same as the variable "k" in the definition of the `SchemaURI[k]` syntax element as specified in 7.2.3 optionally extended to additional schemas. The `SchemaID` syntax element is also used for the decoding of the fragment update payload as described in subclause 8.4.4.<br><br>If the `ContextModeCode` selects a relative addressing mode then the `SchemaID` shall have the same value as in the previous fragment update unit. |

*In subclause 7.6.3, in the second table, add the following semantics after the* `TBC_Counter` *semantic:*

| | |
|---|---|
| SchemaIDOfSBC_Context_Selector | Identifies the schema in which the `Extended_SBC_Context_Selector` selects a declared global element. |
| Extended_SBC_Context_Selector | Selects one global element of the schema referenced by `SchemaIDOfSBC_Context_Selector` using the ContextTBC table as specified in 7.6.5.2.3. |

*In subclause 7.6.3, in the second table, add the following semantic after the* `SBC_Context` *semantic:*

| | |
|---|---|
| AnyElementDecoding() | See 8.5.2.4.5.2 and 8.5.2.4.5.3. |

*In subclause 7.6.3, in the second table, add the following semantics after the* `SubstitutionCode` *semantic:*

| | |
|---|---|
| SchemaIDOfSBC_Operand_Selector | Identifies the schema in which the `Extended_SBC_Operand_Selector` selects a declared global element. |
| Extended_SBC_Operand_Selector | Selects one global element of the schema referenced by `SchemaIDOfSBC_Operand_Selector` using the ContextTBC table as specified in 7.6.5.2.3. |

*In subclause 7.6.3, in the second table, add the following semantic after the* `SBC_Operand` *semantic:*

| | |
|---|---|
| SingleAnyAttributeDecoding() | See 8.5.3.3 |

*In subclause 7.6.5.2.2, add the following bullet after the 6th bullet (i.e. "In the table for OperandTBCs the all-zero SBC…"):*

— In the table for OperandTBCs the all-zero-and-one SBC (ex. 00001) is assigned to the character data in the mixed content of a datatype if the datatype has a mixed content model.

*In subclause 7.6.5.2.2, replace the following text:*

— All other Schema Branch Codes are assigned to the children nodes of the complexType. The children are defined as the attributes of the complex type as well as, either the contained elements or a dedicated child representing a simple content. If there are two or more element declarations with the same name in the complexType definition then each shall be assigned a different SBC.

*by*

— All other Schema Branch Codes are assigned to the children nodes of the complexType. The children are defined as the attributes of the complex type as well as, either the contained elements or a dedicated child representing a simple content. If there are two or more element declarations with the same name in the complexType definition then each shall be assigned a different SBC. If there is an "any" element declared in the complex type then a SBC is also assigned to this element and this SBC is called

"SBC_any". If there is an "anyAttribute" declaration in the complex type then a SBC is also assigned to it and this SBC is called "SBC_anyAttribute".

*In subclause 7.6.5.2.2, replace the following text:*

— The SBCs for child elements and simple content are assigned first, the SBCs for attributes are assigned last. The attributes are ordered lexicographically for the assignment of the Schema Branch Codes.

*by*

— The SBCs for child elements and simple content are assigned first, the SBCs for attributes are assigned last. The attributes are ordered lexicographically for the assignment of the Schema Branch Codes. The lexicographical ordering for an "any" element and for an "anyAttribute" is done with respect to their signature as defined in subclause 8.5.2.2.4

*Replace the entire content of subclause 7.6.5.2.3 by:*

For the special case of the selector node the following rules apply:

If the `AdditionalSchemaFlag` in the binary `DecoderInit` equals '0' then

— The length in bits of these SBCs is determined by the number of global elements declared in the schema referred by the `SchemaID` as follows:

  — SBC_Context_Selector: ceil( log2( number of global elements + 1)).

  — SBC_Operand_Selector: ceil( log2( number of global elements)).

— The SBCs are assigned sequentially to the global elements defined in the schema referred by the `SchemaID`. Before the assignment:

  — in case the `HierarchyBasedSubstitutionCodingFlag` is set to false, a lexicographical ordering of all global elements is performed.

  — in case the `HierarchyBasedSubstitutionCodingFlag` is set to true, a depth first ordering is performed with respect to the hierarchy of element substitutions which forms one or several trees as shown in Figure AMD1-3. For elements which are siblings within the element substitution hierarchy or roots of a substitution hierarchy a lexicographical ordering is performed based on their expanded name as defined in 8.2.

— No codes are assigned for a reference to the parent node nor for the User Data Extension Code. The Path Termination Code, however, is present in the ContextTBC table.

If the `AdditionalSchemaFlag` in the binary `DecoderInit` equals '1' then

— The length in bits of the `Extended_SBC_Context_Selector` respectively the `Extended_SBC_Operand_Selector` is determined by the number of global elements declared in the schema referred by the `SchemaIDOfSBC_Context_Selector` respectively `SchemaIDOfSBC_Operand_Selector` as follows:

  — Extended_SBC_Context_Selector: ceil( log2( number of global elements + 1)).

  — Extended_SBC_Operand_Selector: ceil( log2( number of global elements)).

— The SBCs are assigned sequentially to the global elements defined in the schema referred by the `SchemaIDOfSBC_Context_Selector` respectively `SchemaIDOfSBC_Operand_Selector`. No SBCs are assigned to elements imported from other namespaces into this schema. Before the assignment:

  — in case the `HierarchyBasedSubstitutionCodingFlag` is set to false, a lexicographical ordering of all global elements is performed.

  — in case the `HierarchyBasedSubstitutionCodingFlag` is set to true, a depth first ordering is performed with respect to the hierarchy of element substitutions which forms one or several trees as shown in Figure AMD1-3. For elements which are siblings within the element substitution hierarchy or roots of a substitution hierarchy a lexicographical ordering is performed based on their expanded name as defined in 8.2.

— No codes are assigned for a reference to the parent node nor for the User Data Extension Code. The Path Termination Code, however, is present in the ContextTBC table.

*In subclause 7.6.5.3.1, add the following sentence at the end of the subclause:*

The `GlobalSubstitutionSelect` is used when the substitute element is defined in a other schema than the expected element. In that case, the `GlobalSubstitutionSelect` selects the substitute element from the set of all elements defined in the schema referenced by the `SchemaID`.

*In subclause 7.6.5.3.2, replace the `SubstitutionCode` syntax table by:*

| SubstitutionCode () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (substitution_possible == 1 \|\| external_element_substitution_possible == 1 \|\| all_element_externally_substitutable == 1) { | | |
| **SubstitutionFlag** | 1 | bslbf |
| if (SubstitutionFlag == 1) { | | |
| if ( external_element_substitution_possible == 1 \|\| all_element_externally_substitutable == 1) { | | |
| **SchemaSwitching** | 1 | bslbf |
| if (SchemaSwitching) { | | |
| **SchemaID** | ceil( log2(`NumberOfSchemas` + `NumberOfAdditionalSchemas`)) | uimsbf |
| **GlobalSubstitutionSelect** | ceil(log2 (number_of_global_elements_in_schema_referred_by_SchemaID)) | bslbf |
| } else { | | |
| **SubstitutionSelect** | ceil( log2( number_of_possible_substitutes)) | bslbf |
| } | | |

| | | |
|---|---|---|
| } else { | | |
| **SubstitutionSelect** | ceil( log2( number_of_possible_substitutes)) | bslbf |
| } | | |
| } | | |
| } | | |
| } | | |

*In subclause 7.6.5.3.3, add the following semantics after the* `substitution_possible` *semantic:*

| | |
|---|---|
| external_element_substitution_possible | This internal flag indicates whether the element can be subject to a substitution occurring in an other schema than the one in which the element is defined. This flag is set by the `ExternallySubstitutableType` table defined in subclause 7.7.6.4 and 7.7.6.5. |
| all_element_externally_substitutable | This internal flag indicates whether every element defined in the schema of the expected element can be subject to a substitution occurring in an other schema. This flag is set by the `ExternallySubstitutableType` table defined in subclause 7.7.6.4 and 7.7.6.5. |

*In subclause 7.6.5.3.3 add the following semantics after the* `SubstitutionFlag` *semantic:*

| | |
|---|---|
| SchemaSwitching | Indicates whether the element substitution occurs in an other schema than the schema where the expected element is defined. |
| SchemaID | Identifies the schema in which the substitute element is defined. |
| GlobalSubstitutionSelect | This code identifies the substitute element in the schema of index '`SchemaID`' in the `SchemaURI[k]` table.<br><br>When the `HierarchyBasedSubstitutionCondingFlag` is set to false or when it is not defined in the `DecoderInit`, the code referring to the elements are assigned sequentially starting from zero after lexicographical ordering of all global elements using their expanded names as defined in subclause 8.2.<br><br>When the `HierarchyBasedSubstitutionCodingFlag` is set to true, the `SubstitutionSelect` codes are assigned in a depth-first manner with respect to the hierarchy of element substitutions which forms on or several trees as shown in an example in Figure AMD1-3. For elements which are siblings within the element substitution hierarchy or elements which are roots of a substitution hierarchy the code words are assigned in a lexicographical order based on their expanded names. The order of elements that have a head of substitution in an other schema than the one identified by `SchemaID` are defined in the same relative order than if they were in the *initial schema*.<br><br>The length of this field is determined by "ceil( log2( number_of_global elements in the schema identified by `SchemaID`))" in both cases.<br><br>Note – If schema identified by `SchemaID` is an additional schema, the substitution select codes are computed on the set of all elements defined in the namespace identified by the `SchemaID` entry in the `SchemaURI` table of the `DecoderInit`. |

*In subclause 7.6.5.3.3, replace the semantic of* `SubstitutionSelect` *by:*

| | |
|---|---|
| SubstitutionSelect | This code is used as address within a substitution group where each element defined in the schema of the expected element is assigned a `SubstitutionSelect` code.<br><br>When the `HierarchyBasedSubstitutionCondingFlag` is set to false or when it is not defined in the `DecoderInit`, the `SubstitutionSelect` codes referring to the elements are assigned sequentially starting from zero after lexicographical ordering of the element using their expanded names as defined in subclause 8.2. The length of this field is determined by "ceil( log2( number_of_possible_substitutes in the schema of the expected element))".<br><br>In case the `HierarchyBasedSubstitutionCondingFlag` is true, the `SubstitutionSelect` codes are assigned in a depth-first manner with respect to the hierarchy of element substitutions which forms one or several trees as shown in an example in Figure AMD1-3. For elements which are siblings within the element substitution hierarchy or for elements which are roots of a substitution hierarchy the code words are assigned in a lexicographical order based on their expanded names. The element substitution code identifies the substitute element which is used in the encoded document. The length of the code word for the element substitution code is equal to "ceil( log2( number of possible_substitute in the schema of the expected element))".<br><br>Note – If the schema identified by `SchemaID` is an additional schema, the substitution select codes are computed on the set of all elements defined in the namespace identified by the `SchemaID` entry in the `SchemaURI` table of the `DecoderInit`. |

*In subclause 7.6.5.3.3, add the following figure after the semantics table:*

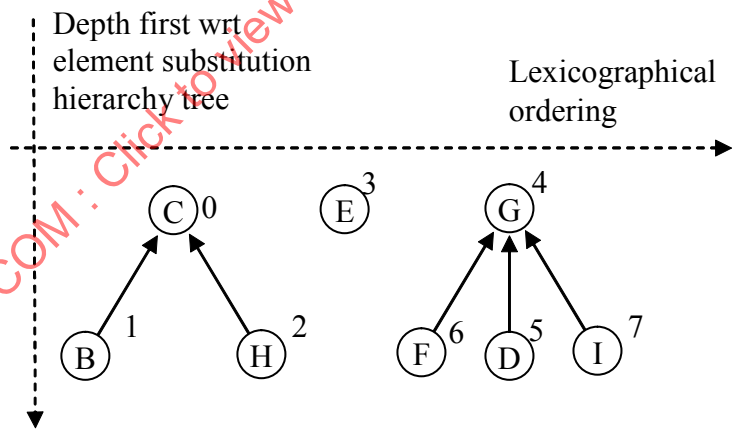



**Figure AMD1-3 - Example for the Element Substitution Identification Code assignment for some elements in the hierarchy based coding mode**

*In subclause 7.6.5.4.1, add the following sentence at the end of the subclause:*

The `GlobalTypeIdentificationCode` is used when the effective type is defined in an other schema than the expected type. In that case, the `GlobalTypeIdentificationCode` selects the effective type from the set of all types defined in the schema referenced by the `SchemaID`.

*In subclause 7.6.5.4.2, replace the* `PathTypeCode` *syntax table by:*

| PathTypeCode () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (type_cast_possible == 1 \|\| external_type_cast_possible == 1 \|\| all_type_externally_castable == 1) { | | |
| **TypeCodeFlag** | 1 | bslbf |
| if ((TypeCodeFlag == 1) { | | |
| if (external_type_cast_possible == 1 \|\| all_type_externally_castable == 1) { | | |
| **SchemaSwitching** | 1 | bslbf |
| if (SchemaSwitching) { | | |
| **SchemaID** | ceil( log2(`NumberOfSchemas` + `NumberOfAdditionalSchemas`)) | uimsbf |
| **GlobalTypeIdentificationCode** | ceil(log2 (number_of_global_types_in_schema_referred_by_SchemaID)) | bslbf |
| } else { | | |
| **TypeIdentificationCode** | ceil( log2( number of derived types)) | bslbf |
| } | | |
| } else { | | |
| **TypeIdentificationCode** | ceil( log2( number of derived types)) | bslbf |
| } | | |
| } | | |
| } | | |
| } | | |

*In subclause 7.6.5.4.3 add the following semantics after the* `type_cast_possible` *semantic:*

| | |
|---|---|
| external_type_cast_possible | Indicates whether the expected type can be subject to a type casting occurring in an other schema than the one in which the type is defined. This flag is set by the `ExternallyCastableType` table defined in subclause 7.7.5.4 and 7.7.5.5. |
| all_type_externally_castable | Indicates whether every type defined in the schema of the expected type can be subject to a type casting occurring in an other schema. This flag is set by the `ExternallyCastableType` table defined in subclause 7.7.5.4 and 7.7.5.5. |

*In subclause 7.6.5.4.3 add the following semantics after the* `TypeCodeFlag` *semantic:*

| | |
|---|---|
| SchemaSwitching | Indicates whether the type cast occurs in an other schema than the schema of the expected type. |
| SchemaID | Identifies the schema in which the derived type element is addressed. |
| GlobalTypeIdentificationCode | Identifies a type defined in `SchemaIDOfDerivation` by a code word.<br><br>The Type Identification Code is generated for a given type (simpleType or complexType) from the set of all types (itself being not included) including abstract types defined in the schema referenced by `SchemaID`.<br><br>The Type Identification Codes are assigned in a depth-first manner with respect to the hierarchy of types which forms a tree as shown in an example in Figure 9. For types which are siblings within the type hierarchy the code words are assigned in a lexicographical order based on their expanded names. The Type Identification Code identifies the derived type which is used for the type cast. The length of the code word for the Type Identification Code is equal to "ceil( log2( number of types in the schema))".<br><br>The order of types that have a super type in an other schema than the one identified by `SchemaID` are defined in the same relative order than if they were in the initial schema.<br><br>Note – If schema identified by `SchemaID` is an additional schema, the type codes are computed on the set of all types defined in the namespace identified by the `SchemaID` entry in the `SchemaURI` table of the `DecoderInit`. |

*In subclause 7.6.5.5.1, replace the following text:*

Within a TBC a Position Code shall uniquely identify the position of a node among its sibling nodes in the binary description tree. It is present only if multiple occurrences are possible for the element referenced by the SBC or for any model group declared in the corresponding complexType definition. Position Codes are distinguished in Multiple element Position Codes (MPC) and Single element Position Codes (SPC) for efficiency reasons. The presence of the Position Code and the decision whether SPC or MPC are used is determined by the complexType definition.

*by*

Within a TBC a Position Code shall uniquely identify the position of a node among its sibling nodes in the binary description tree. Position Codes are distinguished in Multiple element Position Codes (MPC) and Single element Position Codes (SPC) for efficiency reasons. If the `MPCOnlyFlag` in the `DecoderInit` is set to true, MPC are always used. the `MPCOnlyFlag` in the `DecoderInit` is set to false, the presence of the Position Code and the decision whether SPC or MPC are used is determined by the complexType definition. In the second case, a position code is present only if multiple occurrences are possible for the element referenced by the SBC or for any model group declared in the corresponding complexType definition. Also the OperandTBC of character content in a mixed content model contains a position code.

*In subclause 7.6.5.5.1, add the following text and figures after the note:*

If the `InsertFlag` in the Binary `DecoderInit` is set to true then the Position Codes represent rational numbers (Rational Position Codes). Otherwise Position Codes represent integer numbers. In both cases the child elements are sorted in increasing order of these values.

Rational Position Codes are used to allow the insertion of child elements at any specific possible position in the binary description tree. Position Codes representing rational numbers are specified by the following rules:

— Rational Position Codes represent rational numbers in the interval ]0<n<1[.

— Rational Position Codes are encoded in the *vlurmsbf5* format.

In Figure AMD1-4 an example of a binary description tree of the element A including an assignment of position codes to child elements B is given. The Position Codes representing rational numbers specify the order in which the child elements B reside in the binary description tree.

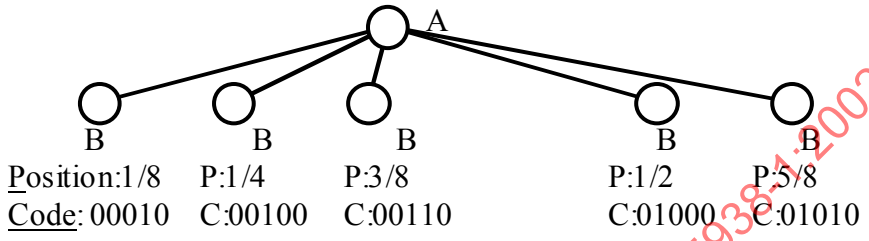



**Figure AMD1-4 - Assignment of Position Codes to a set of child elements**

When a new element B is inserted at any position then a new Position Code representing rational numbers is used so that the correct ordering in the binary description tree is unambiguously specified (see Figure AMD1-5).

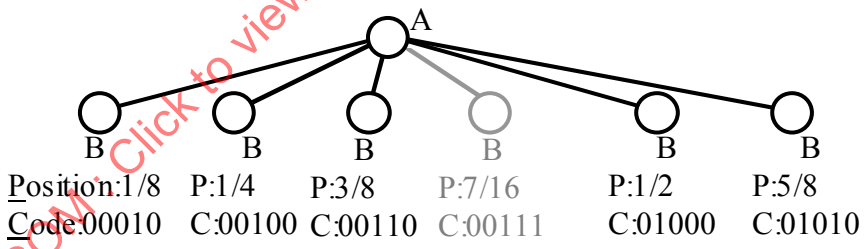



**Figure AMD1-5 - Position Code of an inserted child element B (grey node)**

*In subclause 7.6.5.5.2, replace the following text:*

A SPC is used, if a Position Code is present according to 7.6.5.5.1and if the corresponding complexType does not contain model groups with maxOccurs > 1. The SPC is only present if the SBC addresses an element with maxOccurs > 1. The SPC indicates the position of the node among the nodes addressed by the same SBC.

*by*

A SPC is used, if a Position Code is present according to 7.6.5.5.1, if the MPCOnlyFlag is set to false, and if the corresponding complexType does not contain model groups with maxOccurs > 1. The SPC is only present if the SBC addresses an element with maxOccurs > 1. The SPC indicates the position of the node among the nodes addressed by the same SBC.

*In subclause 7.6.5.5.2, replace the following text:*

The position is represented as integer value. The length in bits of the SPC is the equal to "ceil( log2( maxOccurs of the element addressed by the SBC))". If this length exceeds 4 bits then vluimsbf5 is used for coding the SPC.

*by*

If, according to 7.6.5.5.1, the position is represented as rational number, the value is encoded as vlurmsbf5 .The value 0 shall be omitted.

If, according to 7.6.5.5.1, the position is represented as integer value. The length in bits of the SPC is the equal to "ceil( log2( maxOccurs of the element addressed by the SBC))". If this length exceeds 4 bits then vluimsbf5 is used for coding the SPC.

*In subclause 7.6.5.5.2, add the following text at the end of the subclause:*

In the case of a complex type for which SPCs are used and that has mixed content the OperandTBC assigned to the character data in the mixed content also has a SPC. The position code of this OperandTBC is encoded assuming a maxOccurrence=MPA+1 since before and after each instantiated element character data can be present. The value MPA is specified in subclause 7.6.5.5.3.

*Add the following text at the beginning of subclause 7.6.5.5.3:*

If according to 7.6.5.5.1 the position is represented as rational number then the value is encoded as vlurmsbf5 and the value 0 shall be omitted.

If according to 7.6.5.5.1 the position is represented as integer number then the length in bits of the MPC is determined by the following method, which uses the 'max occurs' property of the effective content particles of the type definition.

*Add the following text after the first paragraph:*

In the case of a complex type that has mixed content model the OperandTBC assigned to the character data also uses a MPC.

*Add the following text after the "For an element declaration particle" bullet:*

In the case of a mixed content model the $MPA_{mixed}$=2MPA+1 since before and after each instantiated element character data can be present.

*Replace subclause 7.6.5.5.4 by the following text and figure:*

If an instantiated element was conveyed as part of a fragment update payload then the corresponding node has not been explicitly assigned a position in the binary format description tree. In this case, the following implicit positions are assigned to each added node for which a position code is expected in the TBC addressing this node:

— If Position Codes represent integer numbers:

  — in the case a MPC is expected: a position is assigned incrementally (starting from zero) to the added elements.

  — in the case a SPC is expected: a position is assigned incrementally (starting from zero) to the added elements corresponding to the same SBC.

— If Position Codes represent rational numbers: to Z consecutive elements the positions represented by rational numbers are assigned by the following steps. In the case a MPC is expected: Z is the number of all elements which have the same parent node. In the case a SPC is expected: Z is the number of all elements which have the same parent node and which correspond to the same SBC.

  — In this steps, P(i) denotes the i-th assigned position.

    **Step1**: Determine Z.

    Calculate N=2^{ceil(log2(Z+1))},

    Set i=0,P=0.

    **Step2**: while(i≤(3Z-N+3)/2 | $mod_2$(i)==0) {P(i)=P+=1/(N); i++;}

**Step3**: while (i<Z) {P(i)=P+=2/N; i++;}. End.In the implicit assignment of rational position codes, the step 2 performs an ascending-oriented assignment and the step 3 performs an balance-oriented assignment. The ascending-oriented assignment is efficient in case of appending subsequent fragments context paths, whereas the balance-oriented assignment is efficient in case of inserting/replacing subsequent fragments context paths. The condition of step 2 controls the ratio between such ascending and balance-oriented assignment. Figure AMD1-6 shows an example of the implicit assignment of positions represented by rational number.

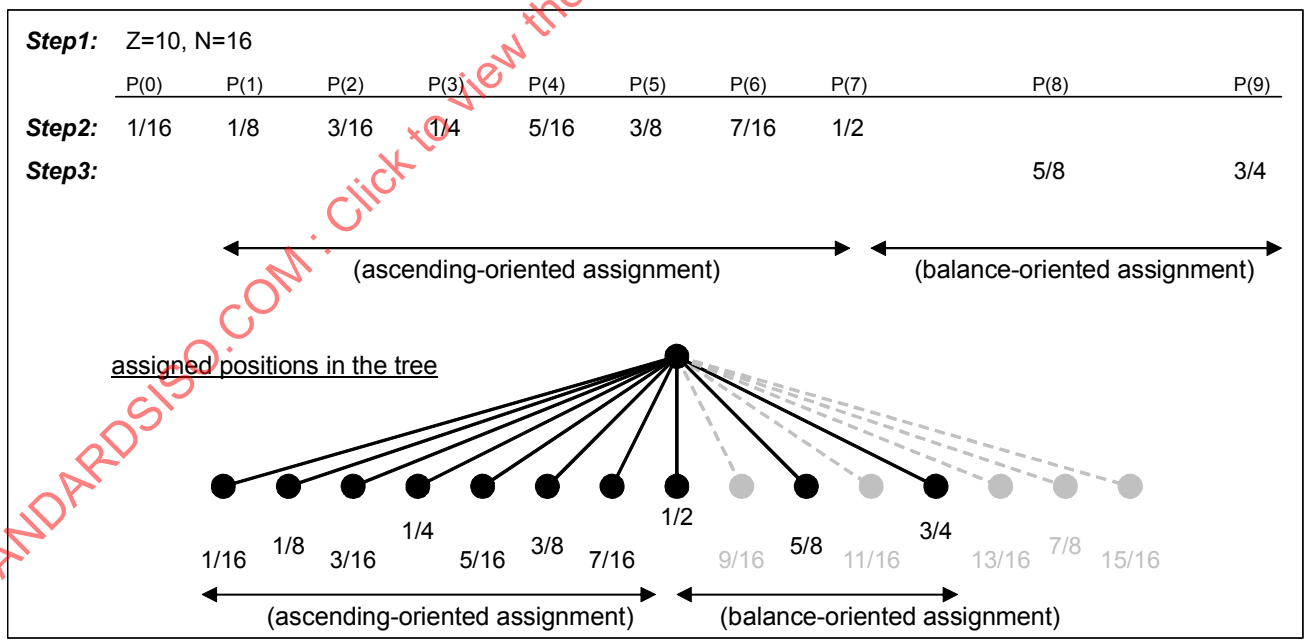



**Figure AMD1-6 - an example on implicit assignment of positions represented by rational numbers**

*In subclause 7.6.5.6, replace the first paragraph by:*

A fragment update unit can contain multiple fragment update payloads of the same type if the context paths of those fragment update payloads are identical except for their position codes. If position codes represent integer numbers, the position codes for the first fragment update payload are coded in the same way as in the case of a single payload, while the position codes for the other fragment update payloads within this fragment update unit are indicated in the context path by “Incremental Position Codes” as shown in Figure 10.

*In subclause 7.6.5.6, add the following paragraph before Figure 10:*

In the case of rational position codes, the structure of the context path is the same as the case of integer position codes. Only the Position Codes and the Incremental Position codes differ. For the Context Path rational position codes are used. Also for the incremental position codes rational position increments are specified. The order of rational position increments are predefined (see Figure AMD1-7).

*In subclause 7.6.5.6, replace the following text:*

The set of multiple-occurrence nodes is indexed beginning from the starting node of the context path. An Incremental Position Code indicates the index of the multiple-occurrence node in the context path for which the position code shall be incremented by 1. The position code for all multiple-occurrence nodes with a higher index is set to “0”.

*by*

The set of multiple-occurrence nodes is indexed beginning from the starting node of the context path. An Incremental Position Code indicates the index of the multiple-occurrence node in the context path for which the position code shall be incremented. The position code for all multiple-occurrence nodes with a higher index is set to an initial value.

If Position Codes represent integer numbers, the position code for the multiple-occurrence node indicated by the Incremental Position Code shall be incremented according to the ascending order, i.e. it shall be incremented by “1”, and the initial value that the position code for all multiple-occurrence nodes with a higher index is set to is “0”.

If Position Codes represent rational numbers, the position codes shall be sorted in the following increment order of rational numbers before they are encoded:

1/2 → 1/4 → 3/4 → 1/8 → 3/8 → 5/8 → 7/8 → 1/16 → …

where, the i-th (i=0,1,2,…) rational number r[i] of this order is expressed by;

r[i] = (2(i+1) +1 - 2^j) / 2^j, where j = 1+int(log2(i+1)).

This order is defined first based on the resolution of the rational numbers which is the order of dividing the area (0,1) into halves repeatedly (Figure AMD1-7 (1)), i.e. the value of denominator. After that the ascending order is applied to the numbers in the same resolution (Figure AMD1-7 (2)).

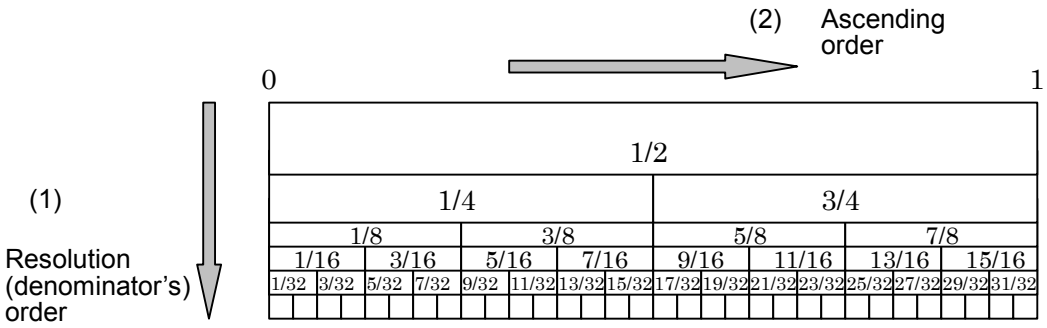



**Figure AMD1-7 - Order of rational numbers**

The position code for the multiple-occurrence node indicated by the Incremental Position Code shall be incremented according to the order of rational numbers. The initial value of the order is "1/2".

The order of fragment update payloads in a fragment update unit is kept in the ascending order of their rational position code values. After decoding the position codes of rational numbers, the decoded position codes shall be re-sorted into the ascending order of their rational code values and be assigned to the multiple payload in this order.

*In subclause 7.6.5.6, replace the following text:*

An example for the multiple fragment update payload mode is given below:

*by*

An example for the multiple fragment update payload mode with integer position codes is given below:

*Add the following text and figure at the end of subclause 7.6.5.6:*

Figure AMD1-8 shows an example of the encoding/decoding processes for the multiple payload mode with rational position codes. If Position Codes represent rational numbers, the position codes are sorted in the order of rational numbers before they are encoded (Figure AMD1-8 (1)). Once the positions are sorted, incremental position coding is applied to the rational position codes with the increment order of rational numbers and the initial value "1/2". After the position codes are decoded, they are re-sorted in the ascending order (Figure AMD1-8 (2)).

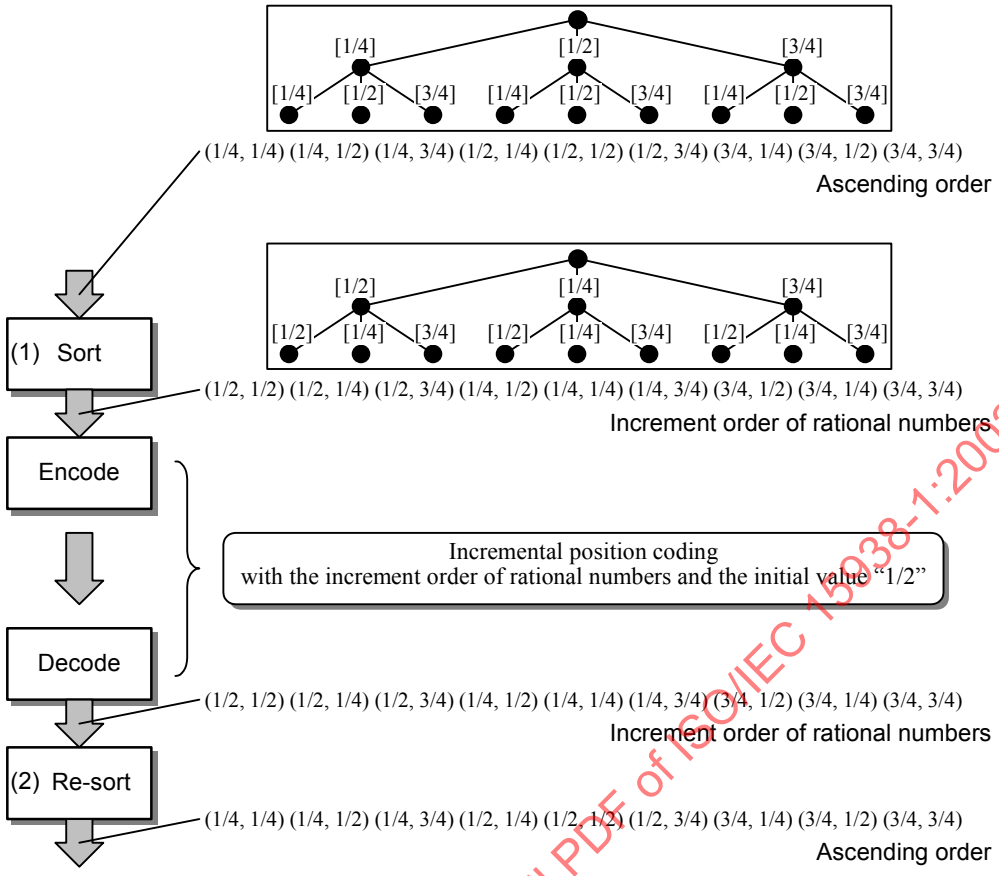



**Figure AMD1-8 - Encoding/Decoding processes for the multiple payload mode with rational position codes**



*Add the following subclause (subclause 7.7):*

## 7.7 Binary Schema Update Unit

### 7.7.1 Overview

In addition to the initial schema and known additional schemas, the decoder accept unknown additional schemas. These *unknown additional schemas* are subject to updates as described in this subclause. Uknown additional schema updates are carried in an access unit by a *schema update unit*.

A schema update unit is composed of a namespace identifier, a set of code tables to represent global elements, global types and global attributes, followed by a binary encoded schema carrying the schema components definitions. This binary encoded schema is encoded using a specific profile of BiM specified in subclause 7.7.8 using a simple XML schema for schema encoding has been defined for this purpose in this specification.

Note - The binary encoded schema only contains information needed by a BiM decoder to properly decode the bitstream. For instance the binary encoded schema does not carry key, unique elements or block. The schema update feature should not be used to carry XML schemas.

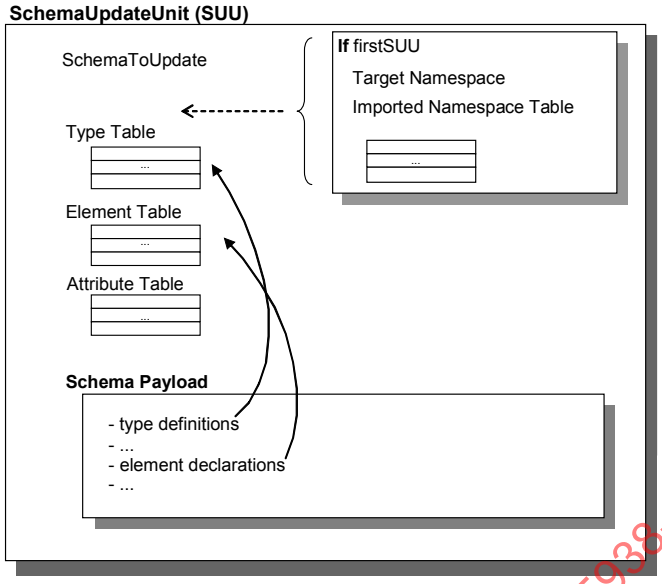



**Figure AMD1-9 - A schema update unit**

Some constraints are applied to the acquisition of schema update units. A specific schema update unit, the so-called first schema update unit, contains initialization information and shall be acquired by the decoder before any description conformant to the transmitted additional schema is decoded. The decoder behavior in case of a first schema update units is missed is not normative. A schema definition already transmitted shall not change during binary description stream lifetime and there shall not be two schema identifiers associated to the same namespace.

The full schema is not always necessary for the decoding of a particular binary description stream. To avoid unnecessary transmission, a schema update unit may contain only the definitions that are required for the decoding of the description stream.

Once received by the decoder, a schema update unit immediately updates schema information managed by the decoder. All the optimised decoders associated to existing types are immediately applied to all types they derive from in accordance to the rules defined for the optimized decoders in Clause 9.

### 7.7.2 Syntax

| SUU () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **SchemaToUpdate** | ceil( log2( NumberOfAdditionalSchemas)) | uimsbf |
| **FirstSUU** | 1 | blsbf |
| If (FirstSUU) { | | |
| **NamespaceURI_Length** | 8+ | vluimsbf8 |
| **NamespaceURI_String** | 8*NamespaceURILength | blsbf |
| ImportedNamespaceTable() | | |
| } | | |
| SchemaTypeTable(SchemaToUpdate) | | |
| SchemaElementTable(SchemaToUpdate) | | |
| SchemaAttributeTable(SchemaToUpdate) | | |
| BinaryEncodedSchema(SchemaToUpdate) | | |
| } | | |

### 7.7.3 Semantics

| *Name* | *Definition* |
|---|---|
| SchemaToUpdate | Specifies the index in the table of schema which is updated by this fragment update unit. |
| FirstSUU | This flag is set to true if the SUU is a FirstSUU. |
| NamespaceURI_Length | Signals the length in bytes of the NamespaceURI_String. |
| NamespaceURI_String | UTF-8 representation of the namespace URI on which the SUU applies. |
| ImportedNamespaceTable | This table conveys the namespace referenced in the binary encoded schema as specified in subclause 7.7.4. |
| SchemaTypeTable | This table conveys the type code tables as specified in subclause 7.7.5. |
| SchemaElementTable | This table conveys the global elements and their possible substitutions as specified in subclause 7.7.6. |
| SchemaAttributeTable | This table conveys the global attributes as specified in subclause 7.7.7. |
| BinaryEncodedSchema | This conveys the binary encoded schema definitions as specified in subclause 7.7.8. |

### 7.7.4 Imported NamespaceTable

#### 7.7.4.1 Overview

This table conveys the table of namespaces that are referenced in the binary encoded schema.

#### 7.7.4.2 Syntax

| ImportedNamespaceTable(Schema){ | **Number of bits** | **Mnemonic** |
|---|---|---|
| **NumberOfImportedNamespaces** | 8+ | vluimsbf8 |
| for (i=0; i < NumberOfNamespaces; i++) { | | |
| **ImportedNamespace_Length[i]** | 8+ | vluimsbf8 |
| **ImportedNamespace[i]** | 8* MappedNamespace_Length[i] | blsbf |
| } | | |
| } | | |

#### 7.7.4.3 Semantics

| *Name* | *Definition* |
|---|---|
| NumberOfImportedNamespaces | Indicates the number of namespaces that can be referred by a schema component definition in the binary encoded schema. |
| ImportedNamespace_Length[i] | Indicates the size in bytes of the `ImportedNamespace[k]`. A value of zero is forbidden. |
| ImportedNamespace[i] | This is the UTF-8 representation of the namespace. |

### 7.7.5 Schema Type Table

#### 7.7.5.1 Overview

This table conveys the table of global types defined in the namespace on which the SUU applies.

#### 7.7.5.2 Schema Type Table Syntax

| SchemaTypeTable (Schema){ | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (FirstSUU) { | | |
| **NumberOfGlobalTypes** | 8+ | vluimsbf8 |
| ExternallyCastableTypeTable(Schema) | | |
| } | | |
| **PartialTransmission** | 1 | blsbf |
| if (PartialTransmission){ | | |
| **NumberOfTransmittedTypes** | 5+ | vluimbsf5 |
| for (i=0; i < NumberOfTransmittedTypes; i++) { | | |
| **TransmittedType** | 5+ | vluimsbf5 |
| **NumOfSubtypes[TransmittedType]** | 5+ | vluimsbf5 |
| } else { | | |
| for (i=0; i < NumberOfGlobalTypes; i++) { | | |
| **NumOfSubtypes[i]** | 5+ | vluimsbf5 |
| } | | |
| } | | |

#### 7.7.5.3 Schema Type Table Semantics

The types are defined in the order of their type codes within the namespace as specified in subclause 7.6.5.4.

| *Name* | *Definition* |
|---|---|
| NumberOfGlobalTypes | Defines the number of global types defined in the namespace. |
| PartialTransmission | Indicates that the transmission of the type table is partial. |
| NumberOfTransmittedTypes | Indicates the number of type definitions that are transmitted in the current SUU. |

| | |
|---|---|
| TransmittedType | Indicates the TypeCode of the type to be updated. |
| NumOfSubtypes[TransmittedType] | Indicates the number of subtype of the type 'TransmittedType' in the namespace. |
| NumOfSubtypes[i] | Indicates the number of subtype of the 'i$^{th}$' type of the namespace. |

#### 7.7.5.4 Externally Castable Type Table Syntax

| ExternallyCastableTypeTable(Schema) { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **IsThereExternallyCastableType** | 1 | blsbf |
| If (IsThereExternalCastableType) { | | |
| **all_type_externally_castable** | 1 | blsbf |
| If(!all_type_externally_castable) { | | |
| **NumberOfExternallyCastableType** | 5+ | vluimsbf5 |
| for(i=0;i< NumberOfExternallyCastableType; i++){ | | |
| **ExternallyCastableType** | ceil( log2( NumberOfGlobalTypes in Schema)) | blsbf |
| } | | |

#### 7.7.5.5 Externally Castable Type Table Semantics

This table allows to specify which types can be subject to a type casting where the subtype is defined in an other namespace than the one carried in the schema update unit.

| *Name* | *Definition* |
|---|---|
| IsThereExternallyCastableType | Signals that some types in the schema to update can be casted into types defined defined in other namespaces. |
| all_type_externally_castable | Signals that all types in the schema to update can be casted into types defined in other namespaces. |
| NumberOfExternallyCastableType | Indicates the number of types that can be casted into types defined in other namespaces. |
| ExternallyCastableType | Indicates the type code of a type which can be casted into types defined in other namespaces. In case this element is subject to a substitution (subclause 7.6.5.4), its `external_type_cast_possible` flag is set to '1'. |

### 7.7.6 Schema Element Tables

#### 7.7.6.1 Overview

This table conveys the global elements and their substitutions on which the SUU applies. They are used to efficiently encode XML Schema substitution groups.

#### 7.7.6.2 Schema Element Table Syntax

| SchemaElementTable (Schema){ | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (FirstSUU) { | | |
| **NumberOfGlobalElements** | 8+ | vluimsbf8 |
| ExternallyCastableElementTable(Schema) | | |
| } | | |
| **PartialTransmission** | 1 | blsbf |
| if (PartialTransmission){ | | |
| **NumberOfTransmittedElements** | 5+ | vluimsbf5 |
| for (i=0; i < NumberOfTransmittedElements; i++) { | | |
| **TransmittedElement** | 5+ | vluimsbf5 |
| **NumOfSubstituteElements[TransmittedElement]** | 5+ | vluimsbf5 |
| } else { | | |
| for (i=0; i < NumberOfGlobalElements; i++) { | | |
| **NumOfSubstituteElements[i]** | 5+ | vluimsbf5 |
| } | | |
| } | | |

#### 7.7.6.3 Schema Element Table Semantics

The elements are defined in the order of their element codes within the namespace as specified in subclause 7.6.5.3.

Note – `HierarchyBasedSubstitutionCodingFlag` is always set to true when additional schemas are supported.

| *Name* | *Definition* |
|---|---|
| NumberOfGlobalElements | Defines the number of global elements defined in the namespace. |
| PartialTransmission | Indicates that the transmission of the element table is partial. |
| NumberOfTransmittedElements | Indicates the number of element definitions that are transmitted in the current SUU. |
| TransmittedElement | Indicates the `SubstitutionSelect` code of the element to be updated. |
| NumOfSubstituteElements [TransmittedElement] | Indicates the number of substitute elements of the TransmittedElement in the updated namespace. |
| NumOfSubstituteElements [i] | Indicates the number of substitute elements of the ‘$i^{th}$’ element of the namespace. |

#### 7.7.6.4 Externally Substitutable Element Table Syntax

| ExternallySubstitutableElementTable(Schema) { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **IsThereExternallySubstitutableElement** | 1 | blsbf |
| If (IsThereExternallySubstitutableElement) { | | |
| **all_element_externally_substitutable** | 1 | blsbf |
| If(!all_element_externally_substitutable) { | | |
| **NumberOfExternallySubstitutableElement** | 5+ | vluimsbf5 |
| for(i=0;i< NumberOfExternallySubstitutableElement;i++){ | | |
| **ExternallySubstitutableElement** | ceil(log2(Number OfGlobalElements in Schema)) | blsbf |
| } | | |

#### 7.7.6.5 Externally Substitutable Element Table Semantics

This table allows to specify which elements can be subject to an "external" element substitution i.e. a substitution in which the substitute element is defined in an other namespace.

| *Name* | *Definition* |
|---|---|
| IsThereExternallySubstituableElement | Signals that some elements in the schema to update can be substituted into elements defined defined in other namespaces. |
| all_element_externally_substitutable | Signals that all elements in the schema to update can be substituted into elements defined in other namespaces. |
| NumberOfExternallySubstitutableElement | Indicates the number of elements that can be substituted into elements defined in other namespaces. |
| ExternallySubstitutableElement | Indicates the element code of an element which can be substituted into elements defined in other namespaces. In case this element is subject to a substitution (subclause 7.6.5.3), its `external_element_substitution_possible` flag is set to '1'. |

### 7.7.7 Schema Attribute Table

#### 7.7.7.1 Overview

This table conveys the global attributes of the updated schema.

#### 7.7.7.2 Syntax

| SchemaAttributeTable(Schema){ | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (FirstSUU) { | | |
| **NumberOfGlobalAttributes** | 8+ | vluimsbf8 |
| } | | |
| **PartialTransmission** | 1 | blsbf |
| if (PartialTransmission){ | | |
| **NumberOfTransmittedAttributes** | 5+ | vluimbsf5 |
| for (i=0; i < NumberOfTransmittedAttributes; i++) { | | |
| **TransmittedAttribute** | ceil(log2(NumberOfGlobal Attributes in SchemaToUpdate)) | uimsbf |
| } | | |
| } | | |

#### 7.7.7.3 Semantics

| *Name* | *Definition* |
|---|---|
| NumberOfGlobalAttributes | Defines the number of global attributes defined in the namespace. |
| PartialTransmission | Indicates that the transmission of the element table is partial. |
| NumberOfTransmittedAttributes | Indicates the number of global attribute definitions that are transmitted in the current SUU. |
| TransmittedAttribute | Indicates the code of the received attribute. |

### 7.7.8 Binary Encoded Schema

#### 7.7.8.1 Overview

Each schema update unit carries a set of schema components definition in its `BinaryEncodedSchema`. This set is represented by an XML file conformant to a specific schema called the schema for encoding schema components. It is carried in a BiM encoded form using the schema for encoding schema components.

Note: The schema for encoding schema components is similar in its spirit to the XML Schema for schema. It has been however dedicated to the encoding of XML in BiM and not for validation as it is the case for the XML Schema for schema. It therefore concentrates on the features that are only used by a BiM decoder for decoding purposes only.

#### 7.7.8.2 Decoding schema components using BiM

##### 7.7.8.2.1 Binary Encoded Schema - DecoderInit

The following specific `DecoderInit` is used by the decoder for the decoding of binary encoded schema.

| DecoderInit() { | **Value** | **Number of bits** |
|---|---|---|
| **SystemsProfileLevelIndication** | 0x00 | 8 |
| **UnitSizeCode** | 000 | 3 |
| **NoAdvancedFeatures** | 0 | 1 |
| **ReservedBits** | 1111 | 4 |
| **AdvancedFeatureFlags_Length** | 0x01 | 8 |
| **InsertFlag** | 0 | 1 |
| **AdvancedOptimisedDecodersFlag** | 1 | 1 |
| **AdditionalSchemaFlag** | 0 | 1 |
| **AdditionalSchemaUpdatesOnlyFlag** | 0 | 1 |
| **FragmentReferenceFlag** | 0 | 1 |
| **MPCOnlyFlag** | 0 | 1 |
| **ReservedBitsZero** | 00 | 2 |
| **NumberOfSchemas** | 1 | 8+ |
| **SchemaURI_Length[0]** | 0x20 (i.e. 32) | 8+ |
| **SchemaURI[0]** | “urn:mpeg:mpeg7:schemaUpdate:2002” | 8* SchemaURI_Length[0] |
| **LocationHint_Length[0]** | 0x00 | 8 |
| **NumOfAdvancedOptimisedDecoderTypes** | 0x01 | 8+ |
| **AdvancedOptimisedDecoderTypeURI_Length[0]** | 0x40 (i.e. 64) | 8+ |
| **AdvancedOptimisedDecoderTypeURI[0]** | “urn:mpeg:mpeg7:systems:SystemsAdvancedOptimisedDecodersCS:2003:1” | 8* AdvancedOptimisedDecoderTypeURI_Length[0] |
| AdvancedOptimisedDecodersConfig () { | | |
| **NumOfAdvancedOptimisedDecoderInstances** | 0x00 | 8 |
| **NumOfMappings** | 0x00 | 8 |
| } | | |
| **InitialDescription_Length** | 0x00 | 8 |
| } | | |
| } | | |

#### 7.7.8.2.2 Binary Encoded Schema - Access Unit Constraints

A schema update unit is carried in one access unit constrained by the following rules:

— The access unit shall contain only one fragment update unit ;

— The fragment update unit shall update the top most node ;

— The fragment update unit shall use a ‘AddContent” command ;

— The fragment update unit shall have a context mode code set to ‘001’ ;

— The `lengthCodingMode` code of the fragment update payload shall be set to ‘00’ ;

— The `hasDeferredNodes` flag of the fragment update payload shall be set to '0' ;

— The `hasTypeCasting` flag of the fragment update payload shall be set to '1' ;

— The `hasNoFragmentReference` flag of the fragment update payload shall be set to '1'.

Moreover in the fragment update payload the following rules applies:

— The references (e.g. "base" or "type" attributes in XML Schema) to elements, types or attributes are encoded with "SchemaID" (in the local imported namespaces table) + "global code"

#### 7.7.8.2.3 Binary Encoded Schema – Schema

The encoded schema shall respect the following constraints:

— Global types, elements and attributes are encoded in the same order than the one defined by their respective tables in the schema update units (`SchemaTypeTable`, `SchemaElementTable` and `SchemaAttributeTable`);

— Attributes in complex type definitions are sorted according to their expanded name;

— Content models shall be normalized as described in subclause 8.5.2.2.4.

### 7.7.8.3 Mapping schema components to the schema for encoding

#### 7.7.8.3.1 Overview

The following subclauses specify the syntax elements and associated semantics of the schema for encoding schema updates.

The following schema wrapper shall be applied to the syntax defined in subclause 7.7.8.3.

```
<schema xmlns="http://www.w3.org/2001/XMLSchema"

   xmlns:m7s="urn:mpeg:mpeg7:systems:encodingschema:amd1:2004"
   targetNamespace="urn:mpeg:mpeg7:systems:encodingschema:amd1:2004"
     elementFormDefault="qualified"
     attributeFormDefault="unqualified">

   <!-- here clause 7.7.8.3 schema definitions -->

</schema>
```

#### 7.7.8.3.2 Main schema element and type

##### 7.7.8.3.2.1 Syntax

```
<xs:element name="schema" type="schemaType"/>

<xs:complexType name="schemaType">
  <xs:sequence>
```

```
   <xs:element name="typeDefinitions" type="typeDefinitionsType" minOccurs="0"/>
   <xs:element name="anonymousTypeDefinitions"
type="anonymousTypeDefinitionsType"
                                          minOccurs="0"/>
   <xs:element name="elementDeclarations" type="elementDeclarationsType"
                                          minOccurs="0"/>
   <xs:element name="attributeDeclarations" type="attributeDeclarationsType"
     minOccurs="0"/>
  </xs:sequence>
  <xs:attribute name="elementFormDefault"   type="qualificationType"
                           use="optional" default="unqualified"/>
  <xs:attribute name="attributeFormDefault" type="qualificationType"
                           use="optional" default="unqualified"/>
</xs:complexType>

<xs:simpleType name="qualificationType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="qualified"/>
    <xs:enumeration value="unqualified"/>
  </xs:restriction>
</xs:simpleType>
```

#### 7.7.8.3.2.2 Semantics

| *Name* | *Definition* |
|---|---|
| schema | The root element of the schema update. |
| schemaType | The set of schema components updated by this schema update.<br><br>Note - The namespace of this schema is encoded within the SchemaUpdateUnit and therefore not encoded here. |
| typeDefinitions | conveys the list of named types (or type globally defined). |
| anonymousTypeDefinitions | conveys the list of anonymous types (or type locally defined). |
| elementDeclarations | conveys the list of global elements. |
| attributeDeclarations | conveys the list of global attributes. |
| elementFormDefault | identical to the ‘elementFormDefault’ attribute defined in XML schema. |
| attributeFormDefault | identical to the ‘attributeFormDefault’ attribute defined in XML schema. |
| qualificationType | A type used to define the qualification (qualified/unqualified) of elements and attributes. This type is used by the 'form', 'elementFormDefault' and 'attributeFormDefault' attributes. |

#### 7.7.8.3.3 Element Declaration

##### 7.7.8.3.3.1 Syntax

```
<xs:complexType name="elementDeclarationsType">
  <xs:sequence minOccurs="0" maxOccurs="unbounded">
    <xs:element name="globalElement">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="elementTypeReference" type="typeReferenceType"/>
        </xs:sequence>
        <xs:attribute name="name" type="xs:string" use="required"/>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>

<xs:simpleType name="nameStringType">
  <xs:restriction base="xs:string"/>
</xs:simpleType>
```

##### 7.7.8.3.3.2 Semantics

| *Name* | *Definition* |
|---|---|
| elementDeclarationsType | The list of all global element declarations carried by this schema update unit. This list shall be ordered as specified in the specification (See subclause 7.7.6). |
| nameStringType | Defines the type of all the names used in the schema i.e. attribute, element and type names. |

#### 7.7.8.3.4 Type Declaration

##### 7.7.8.3.4.1 Syntax

```
<xs:complexType name="typeDefinitionsType">
  <xs:choice maxOccurs="unbounded">
    <xs:element name="complexType" type="namedComplexTypeType"/>
    <xs:element name="simpleType" type="namedSimpleTypeType"/>
  </xs:choice>
</xs:complexType>

<xs:complexType name="anonymousTypeDefinitionsType">
  <xs:element name="complexType" type="anonymousComplexTypeType"
                                  maxOccurs="unbounded"/>
  <xs:element name="simpleType" type="anonymousSimpleTypeType"
    maxOccurs="unbounded"/>
</xs:complexType>
```

#### 7.7.8.3.4.2 Semantics

| *Name* | *Definition* |
|---|---|
| typeDefinitionsType | This type conveys the list of all the global types (complex and simple) carried by this schema update. The global type (or named type) are the types globally defined in an XML schema declaration.This list shall be ordered as defined in 7.7.5. The number of types contained in this list is encoded in the `SchemaTypeTable` (see 7.7.5.2) |
| complexType | conveys a complex type definition. |
| simpleType | conveys a simple type definition. |
| anonymousTypeDefinitionsType | The list of all the anonymous types (or locally defined). No order is required on this list. In the case of a partial transmission, all the anonymous type required for resolving the type referencing mechanism shall be present in the schema update unit (see type referencing mechanism in 7.7.8.3.7). |
| complexType | conveys a complex type definition. |
| simpleType | conveys a simple type definition. |

### 7.7.8.3.5 Type Definition

#### 7.7.8.3.5.1 Syntax

```
<xs:complexType name="typeType" abstract="true">
   <xs:sequence>
     <xs:element name="derivation" minOccurs="0">
       <xs:complexType>
         <xs:sequence>
             <xs:element name="baseTypeReference" type="typeReferenceType"
                                                  minOccurs="1"/>
         </xs:sequence>
         <xs:attribute name="type" type="derivationType"
           use="required"/>
       </xs:complexType>
     </xs:element>
   </xs:sequence>
</xs:complexType>

<xs:simpleType name="derivationType">
   <xs:restriction base="xs:string">
     <xs:enumeration value="extension"/>
     <xs:enumeration value="restriction"/>
   </xs:restriction>
</xs:simpleType>

<xs:complexType name="complexTypeType" abstract="true">
   <xs:complexContent>
     <xs:extension base="typeType">
       <xs:sequence>
         <xs:element name="attributes" minOccurs="0">
```

```
        <xs:complexType>
          <xs:sequence>
            <xs:choice minOccurs="0" maxOccurs="unbounded">
              <xs:element name="attribute" type="localAttributeType"/>
              <xs:element name="attributeRef" type="attributeRefType"/>
            </xs:choice>
            <xs:element name="anyAttribute" type="anyAttributeType"
              minOccurs="0"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="content" type="contentModelType"/>
    </xs:sequence>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>

<xs:complexType name="namedComplexTypeType" >
 <xs:complexContent>
  <xs:extension base="complexTypeType">
   <xs:attribute name="name" type="nameStringType"use="required"/>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>

<xs:complexType name="anonymousComplexTypeType">
 <xs:complexContent>
  <xs:extension base="complexTypeType">
   <xs:attribute name="id" type="AnonymousTypeIDType" use="required"/>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>

<xs:complexType name="simpleTypeType" abstract="true">
 <xs:complexContent>
  <xs:extension base="typeType">
   <xs:sequence>
    <xs:choice>
     <xs:element name="list">
      <xs:complexType>
       <xs:sequence minOccurs="1">
        <xs:element name="itemTypeReference" type="typeReferenceType"/>
       </xs:sequence>
      </xs:complexType>
     </xs:element>
     <xs:element name="union">
      <xs:complexType>
       <xs:sequence minOccurs="1" maxOccurs="unbounded">
        <xs:element name="memberTypeReference" type="typeReferenceType"/>
       </xs:sequence>
      </xs:complexType>
     </xs:element>
    </xs:choice>
    <xs:sequence minOccurs="0" maxOccurs="unbounded">
     <xs:element name="facet" type="facetType"/>
    </xs:sequence>
   </xs:sequence>
  </xs:extension>
 </xs:complexContent>
</xs:complexType>
```

```
<xs:complexType name="namedSimpleTypeType" >
   <xs:complexContent>
     <xs:extension base="simpleTypeType">
       <xs:attribute name="name" type="nameStringType" use="required"/>
     </xs:extension>
   </xs:complexContent>
</xs:complexType>

<xs:complexType name="anonymousSimpleTypeType">
   <xs:complexContent>
     <xs:extension base="simpleTypeType">
       <xs:attribute name="id" type="AnonymousTypeIDType" use="required"/>
     </xs:extension>
   </xs:complexContent>
</xs:complexType>
```

#### 7.7.8.3.5.2 Semantics

| *Name* | *Definition* |
|---|---|
| typeType | The abstract type of all types. This type defines derivation information for its subtypes `complexTypeType` or `simpleTypeType`. |
| derivation | defines the derivation methods by which a type is defined from its supertype (extension or restriction). |
| baseTypeReference | identifies the supertype of the types as defined in XML schema. |
| derivationType | identifies the derivation type (i.e. extension or restriction) as defined in XML schema. |
| complexTypeType | The abstract type of all complex type definitions. Its subtypes are `namedComplexTypeType` (used in case of type globally defined) and `anonymousComplexTypeType` (used in case of type locally defined) |
| attributes | The list of attributes declared within the complex type. The list shall be transmitted in the order defined in 8.5.3. In case of derivation by restriction, the entire list of attributes shall be listed. In case of derivation by extension, only new attributes shall be listed. |
| attribute | a locally defined attribute (cf. 7.7.8.3.8). |
| attributeRef | a reference to a global attribute defined in a schema (cf. 7.7.8.3.8). |
| anyAttribute | indicates the use of the anyAttribute (cf. 7.7.8.3.8). |
| content | defines the content model of a complexType. (cf.7.7.8.3.9). |
| namedComplexTypeType | A globally defined complex type. Its name shall be present. |
| anonymousComplexTypeType | A locally defined complexType. an ID is associated to each anonymous type (cf. 7.7.8.3.7) |
| simpleTypeType | The abstract type of all simple type definitions. Its subtypes are `namedSimpleTypeType` (used in case of type globally defined) and `anonymousSimpleTypeType` (used in case of type locally defined). |

| | |
|---|---|
| list | If the Simple type is defined as a list, this element contains a reference to the item type which constitutes the element of the list |
| union | If the simple type is defined as an union, this elements contains a reference to the different possible items of the union. The order of the elements has the same semantics than the defined in XML schema. |
| facet | conveys the facets of a simple type |
| namedSimpleTypeType | a globally defined simple type. Its name shall be present. |
| anonymousSimpleTypeType | a locally defined simpleType (or anonymous type). An ID shall be associated to each anonymous type (cf. 7.7.8.3.7) |

#### 7.7.8.3.6 Type and Element Referencement

##### 7.7.8.3.6.1 Syntax

```
<xs:complexType name="typeReferenceType">
  <xs:choice>
    <xs:element name="namedTypeReference">
      <xs:complexType>
        <xs:attribute name="NamespaceID" type="NamespaceIDType"
              use="optional"/>
        <xs:attribute name="TypeID" type="TypeIDRefType"
          use="required"/>
      </xs:complexType>
    </xs:element>
    <xs:element name="anonymousTypeReference">
      <xs:complexType>
        <xs:attribute name="idref" type="AnonymousTypeIDRefType"
          use="required"/>
      </xs:complexType>
    </xs:element>
  </xs:choice>
</xs:complexType>

<xs:complexType name="elementReferenceType">
  <xs:sequence>
    <xs:element name="namedElementReference">
      <xs:complexType>
        <xs:attribute name="NamespaceID" type="NamespaceIDType"
          use="optional"/>
        <xs:attribute name="ElementID" type="ElementIDRefType"
          use="required"/>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>

<xs:simpleType name="NamespaceIDType">
  <xs:restriction base="xs:nonNegativeInteger"/>
</xs:simpleType>

<xs:simpleType name="TypeIDRefType">
  <xs:restriction base="xs:nonNegativeInteger"/>
```

```
</xs:simpleType>

<xs:simpleType name="ElementIDRefType">
  <xs:restriction base="xs:nonNegativeInteger"/>
</xs:simpleType>

<xs:simpleType name="AnonymousTypeIDType">
  <xs:restriction base="xs:nonNegativeInteger"/>
</xs:simpleType>

<xs:simpleType name="AnonymousTypeIDRefType">
  <xs:restriction base="AnonymousTypeIDType"/>
</xs:simpleType>
```

#### 7.7.8.3.6.2 Semantics

| *Name* | *Definition* |
|---|---|
| typeReferenceType | A reference to a type. This type is used when an element refers to a type or when a type refers to its super type. Two kind of types can be referenced: a named type (globally defined) or a anonymous type (locally defined). |
| namedTypeReference | The 'NamespaceID' attribute gives the index of the namespace, in the imported namespace table, in which the type is defined. The 'TypeID' attribute gives the index of the global type in the schema identified by the NamespaceID. If 'NamespaceID' attribute is not present, the namespace of the global type is the target namespace of the Schema Update. |
| anonymousTypeReference | The idref attribute gives the index in the table of anonymous type.. |
| elementReferenceType | A reference to an element.The 'NamespaceID' attribute gives the index of the namespace, in the imported namespace table, in which the element is defined. The 'ElementID' attribute gives the index of the global element in the schema identified by the NamespaceID. If 'NamespaceID' attribute is not present, the namespace of the global element is the target namespace of the Schema Update. |
| NamespaceIDType | Defines the namespace id and refers to the table of imported namespace defined in the Schema Update Unit. |
| TypeIDRefType | Defines the type id and refers to the table of types carried in the Schema Update Unit. |
| ElementIDRefType | Defines the element id and refers to the table of types carried in the Schema Update Unit. |
| AnonymousTypeIDType | Defines the type id of an anonymous type. The scope of this id is limited to the current schema update unit. Therefore, in case of non complete transmission, Id values can be reused to identify different anonymous types. |
| AnonymousTypeIDRefType | Defines a reference to an anonymous type. |

#### 7.7.8.3.7 Attribute definition

##### 7.7.8.3.7.1 Syntax

```
<xs:complexType name="attributeDeclarationsType">
  <xs:sequence>
    <xs:element name="attribute" type="globalAttributeType"
      maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="attributeType" abstract="true">
  <xs:sequence>
    <xs:element name="typeReference" type="typeReferenceType"/>
  </xs:sequence>
  <xs:attribute name="name" type="nameStringType"  use="required"/>
  <xs:attribute name="defaultValue" type="xs:string" use="optional"/>
</xs:complexType>

<xs:complexType name="attributeRefType">
  <xs:attribute name="idref" type="xs:IDREF" use="required"/>
</xs:complexType>

<xs:complexType name="localAttributeType">
  <xs:complexContent>
    <xs:extension base="attributeType">
      <xs:attribute name="use" type="useType" use="required"/>
      <xs:attribute name="form" type="qualificationType" use="required"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="globalAttributeType">
  <xs:complexContent>
    <xs:extension base="attributeType"/>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="anyAttributeType">
</xs:complexType>

<xs:simpleType name="useType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="optional"/>
    <xs:enumeration value="required"/>
  </xs:restriction>
</xs:simpleType>
```



##### 7.7.8.3.7.2 Semantics

| *Name* | *Definition* |
|---|---|
| attributeDeclarationsType | The list of all the global attribute declarations carried by this schema update. This list is ordered as specified in subclause 7.7.7. |

| | |
|---|---|
| attributeType | An abstract type conveying the definition of an attribute. The type of the defined attribute is identified by a type reference. The name of the attribute shall be present. The defaultValue, if it exists, shall be encoded. |
| attributeRefType | A reference to a global attribute. It is used when a type references a global attribute. |
| localAttributeType | Defines the type of an attribute defined within a complex type. The `use` attribute shall be present. Its semantics is identical to the one defined in XML schema. The `form` attribute shall be instantiated, its semantics is identical to the one defined in XML schema. |
| globalAttributeType | Defines the type of a global attribute. |
| anyAttributeType | Indicates that any attribute of any schema can be present in the complexType. |
| useType | The type of the `use` attribute. It has two possible values : 'optional' or 'required'. |

#### 7.7.8.3.8 Content Model

##### 7.7.8.3.8.1 Syntax

```
<xs:complexType name="contentModelType" abstract="true"/>

<xs:complexType name="emptyContentModelType">
  <xs:complexContent>
    <xs:extension base="contentModelType"/>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="simpleContentModelType">
  <xs:complexContent>
    <xs:extension base="contentModelType">
      <xs:sequence>
        <xs:element name="simpleTypeReference"
          type="typeReferenceType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="complexContentModelType">
  <xs:complexContent>
    <xs:extension base="contentModelType">
      <xs:sequence>
        <xs:element name="particle" type="particleType"/>
      </xs:sequence>
      <xs:attribute name="mixed" type="xs:boolean" use="required"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

#### 7.7.8.3.8.2 Semantics

| *Name* | *Definition* |
|---|---|
| contentModelType | This abstract type defines the content model of a complex type. It has three subtypes addressing the three content models defined by XML Schema: `emptyContentModelType`, `simpleContentModelType` and `complexContentModelType`. |
| emptyContentModelType | An empty content model. |
| simpleContentModelType | A simple content model. It includes a reference to the simple type which defines the content model of a complex type. |
| complexContentModelType | A complex content model. This model contains a particle (see XML schema) and its 'mixed' attribute shall be instantiated. |

### 7.7.8.3.9 Facet Definition

#### 7.7.8.3.9.1 Syntax

```
<xs:complexType name="facetType" abstract="true">
  <xs:attribute name="name" type="possibleFacet" use="required"/>
  <xs:attribute name="value" type="xs:string"/>
</xs:complexType>

<xs:simpleType name="possibleFacet">
  <xs:restriction base="xs:string">
    <xs:enumeration value="maxExclusive"/>
    <xs:enumeration value="minExclusive"/>
    <xs:enumeration value="minInclusive"/>
    <xs:enumeration value="maxInclusive"/>
    <xs:enumeration value="enumeration"/>
    <xs:enumeration value="length"/>
    <xs:enumeration value="minLength"/>
    <xs:enumeration value="maxLength"/>
  </xs:restriction>
</xs:simpleType>
```

#### 7.7.8.3.9.2 Semantics

| *Name* | *Definition* |
|---|---|
| facetType | Defines the possible facets associated to a simple type. A facet is composed of a name and a value. The facet mechanism is equivalent to the one defined in XML schema. |
| possibleFacet | The set of possible facets are limited to the ones used by BiM (see 8.5.4). |

#### 7.7.8.3.10 Particle Defintion

##### 7.7.8.3.10.1 Syntax

```
<xs:complexType name="particleType" abstract="true">
  <xs:attribute name="minOccurs" type="xs:unsignedInt" default="1"/>
  <xs:attribute name="maxOccurs" type="occurrenceType" default="1"/>
</xs:complexType>

<xs:complexType name="anyParticleType">
  <xs:complexContent>
    <xs:extension base="particleType"/>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="element">
  <xs:complexContent>
    <xs:extension base="particleType">
      <xs:sequence>
        <xs:element name="type" type="typeReferenceType"/>
      </xs:sequence>
      <xs:attribute name="name" type="nameStringType"/>
      <xs:attribute name="form" type="qualificationType"/>
      <xs:attribute name="nillable" type="xs:boolean" use="required"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="elementRef">
  <xs:complexContent>
    <xs:extension base="particleType">
      <xs:sequence>
        <xs:element name="ref" type="elementReferenceType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="modelGroupType" abstract="true">
  <xs:complexContent>
    <xs:extension base="particleType">
      <xs:sequence maxOccurs="unbounded">
        <xs:element name="particle" type="particleType"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="sequence">
  <xs:complexContent>
    <xs:extension base="modelGroupType"/>
  </xs:complexContent>
</xs:complexType>

<xs:complexType name="all">
  <xs:complexContent>
    <xs:extension base="modelGroupType"/>
  </xs:complexContent>
```

```
</xs:complexType>

<xs:complexType name="choice">
  <xs:complexContent>
    <xs:extension base="modelGroupType"/>
  </xs:complexContent>
</xs:complexType>

<xs:simpleType name="occurrenceType">
  <xs:union memberTypes="unboundedType xs:unsignedInt"/>
</xs:simpleType>

<xs:simpleType name="unboundedType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="unbounded"/>
  </xs:restriction>
</xs:simpleType>
```

#### 7.7.8.3.10.2 Semantics

| *Name* | *Definition* |
|---|---|
| particleType | An abstract type defining the type of all particles (cf. XML Schema). The range of occurrences are defined by the `minOccurs` and `maxOccurs` attributes. |
| anyParticleType | The any wildcard. This particle indicates that any global element of any namespace can be present in the description. |
| element | A local declaration of an element. This declaration is composed of a reference to a type, a name, a qualification form and a nillable property. |
| elementRef | A reference to an element globally defined. |
| modelGroupType | This particle is the super type of all groups: sequence, choice and all |
| sequence | A ‘sequence’ particle. |
| all | An ‘all’ particle. |
| choice | A ‘choice’ particle. |
| occurrenceType | The type for the `maxOccurs` attribute. Its value can be either an ‘xs:unsignedInt’ or the string value ‘unbounded’. |

*In subclause 8.1, replace the following sentence:*

The binary fragment update payload syntax (`FUPayload`) is specified in subclause . It is composed of flags which define some decoding modes and a payload content which is either an `element` or a simple value (`simpleType`). …

*by*

The binary fragment update payload syntax (`FUPayload`) is specified in subclause 8.3. It is composed of flags which define some decoding modes and a payload content which is either an `element`, a simple value (`simpleType`) or a reference to a payload. …

*In subclause 8.3.2.1, replace the DecodingModes syntax table by:*

| DecodingModes () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **lengthCodingMode** | 2 | bslbf |
| **hasDeferredNodes** | 1 | bslbf |
| **hasTypeCasting** | 1 | bslbf |
| **hasNoFragmentReference** | 1 | bslbf |
| **ReservedBits** | 3 | bslbf |
| } | | |

*In subclause 8.3.2.2, add the following semantic after the `hasTypeCasting` semantic:*

| | |
|---|---|
| hasNoFragmentReference | A flag which specifies if this fragment update payload contains a fragment reference or the encoded fragment. This 1-bit flag can have the following values:<br>— 0 – `hasNoFragmentReference` is equal to false,<br>— 1 – `hasNoFragmentReference` is equal to true. |

*In subclause 8.4.1.1 replace the `Element` syntax table by:*

| Element (Enumeration SchemaModeStatus, SchemaComponent theType) { | **Number of bits** | **Mnemonic** |
|---|---|---|
| if (!hasNoFragmentReference) { | | |
| FragmentReference() | | |
| } else if (NumberOfSchemas >1) { | | |
| if (SchemaModeStatus == "hot") { | | |
| **SchemaModeUpdate** | 1-3 | vlclbf |
| } | | |
| if (ElementContentDecodingMode == "mono"){ | | |
| Mono-VersionElementContent(ChildrenSchemaMode, theType ) | | |
| } else { | | |
| Multiple-VersionElementContent(ChildrenSchemaMode, theType ) | | |
| } | | |
| } else { | | |
| Mono-VersionElementContent(“mono”, theType) | | |
| } | | |
| } | | |

*In subclause 8.4.1.2, add the following semantic at the first position:*

| | |
|---|---|
| FragmentReference | See 8.4.8. |

*In subclause 8.4.3.3, replace the syntax element* `SchemaIDOfSubstitution` *by:*

| | | |
|---|---|---|
| **SchemaIDOfSubstitution** | ceil( log2( `NumberOfSchemas + NumberOfAdditionalSchemas`)) | bslbf |

*In subclause 8.4.3.4, replace the semantic of* `SchemaIDOfSubstitution` *by:*

| | |
|---|---|
| SchemaIDOfSubstitution | The version identifier which refers to the schema where the substitute element is defined. Its value is the index of the URI in the `SchemaURI` array defined in 7.2 (optionally extended with the list of additional schemas). |

*In subclause 8.4.4.1, replace the syntax element of* `SchemaID` *by:*

| | | |
|---|---|---|
| **SchemaID** | ceil( log2( `NumberOfSchemas + NumberOfAdditionalSchemas`)) | bslbf |

*In subclause 8.4.4.2, replace the semantic of* `SchemaID` *by:*

| | |
|---|---|
| SchemaID | Identifies the schema which is needed to decode this `ElementContentChunk`. Its value is the index of the URI in the `SchemaURI` array defined in 7.2 (optionally extended with the list of additional schemas). |

*In subclause 8.4.7.1, replace the syntax table of* `SimpleType` *by:*

| SimpleType(SchemaComponent theType) { | **Number of bits** | **Mnemonic** |
|---|---|---|
| If ( ! AdvancedOptimisedDecodersFlag) { | | |
| if (useOptimisedDecoder(theType)) { | | |
| optimisedDecoder(theType) | | |
| } else { | | |
| defaultDecoder(theType) | | |
| } | | |
| } else { | | |
| if (numOfMappedOptimisedDecoder(theType) !=0 ) { | | |
| **optimisedDecoderID** | ceil( log2( number of decoders associated to this type)) | blsbf |
| advancedOptimisedDecoder(theType, optimisedDecoderID) | | |

| | | |
|---|---|---|
| } else { | | |
| defaultDecoder(theType) | | |
| } | | |
| } | | |

*In subclause 8.4.7.2, add the following text at the beginning of the subclause:*

A simple type can be associated to a single default simple type decoder, a single simple optimised decoder and one or several optimised decoders. This syntax table describes the process to select the proper simple type decoder for each simple type to be decoded.

*In subclause 8.4.7.2, add the following semantic after the* `useOptimisedDecoder` *semantic:*

| | |
|---|---|
| numOfMappedOptimisedDecoder () | Returns the number of advanced optimised decoders associated to the type `theType` as described in Clause 9. |

*In subclause 8.4.7.2, replace the* `optimisedDecoder` *semantic by:*

| | |
|---|---|
| optimisedDecoder () | Triggers the simple optimised type decoder associated to the type `effectiveType` as conveyed in the `DecoderInit` (refer to subclause 7.2). |

*In subclause 8.4.7.2, add the following semantic after the* `defaultDecoder` *semantic:*

| | |
|---|---|
| advancedOptimisedDecoder(aType, anInteger) | Triggers the advanced optimised decoder identified by the `optimisedDecoderID` field which is associated to the type `theType` in the optimised decoder mapping. |

*Add the following subclause (subclause 8.4.8):*

### 8.4.8 FragmentReference

#### 8.4.8.1 Syntax

| FragmentReference () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **isDeferred** | 1 | bslbf |
| **hasSpecificFragmentReferenceFormat** | 1 | bslbf |
| **ReservedBits** | 6 | bslbf |
| If (hasSpecificFragmentReferenceFormat == '1') { | | |
| **FragmentReferenceFormat** | 8 | bslbf |
| } else { | | |
| FragmentReferenceFormat = SupportedFragmentReferenceFormat[0] | | |
| } | | |

| | | |
|---|---|---|
| **FragmentRefLength** | 8+ | vluimsbf8 |
| /** FragmentRef **/ | | |
| if(FragmentReferenceFormat == "0x01" ) { | | |
| URIFragmentReference() | | |
| } else { | | |
| **ReservedBits** | FragmentRef Length | |
| } | | |
| /** Fragment ref end **/ | | |
| } | | |

#### 8.4.8.2 Semantics

| *Name* | *Definition* |
|---|---|
| isDeferred | A flag which signals if the fragment is deferred, and therefore can be acquired later on by the terminal.<br><br>If the `isDeferred` has a value of "0", the decoder shall resolve the reference and obtain the fragment payload according to the process described in subclause 5.8.1.<br><br>If the `isDeferred` has a value of "1", then the decoded value of the fragment shall include a deferred reference containing the specified fragment reference as specified in subclause 5.8.2. A node that is represented by a deferred fragment reference shall be treated by the decoder as a deferred node. |
| hasSpecificFragmentReferenceFormat | A flag which signals if the fragment reference format is different from the default one defined in the `DecoderInit` (see subclause 7.2):<br><br>— If `hasSpecificFragmentReferenceFormat` has a value of '1', the decoder shall use the `FragmentReferenceFormat` field as indication of the fragment reference format.<br><br>— If `hasSpecificFragmentReferenceFormat` has a value of '0' then the decoder shall take the fragment reference format to be that defined within the `DecoderInit` i.e. the default setting. |
| FragmentReferenceFormat | An 8-bits value which uniquely identifies the format of the contained fragment reference as defined in Table AMD1-1. This field shall only be present when `hasSpecificFragmentReferenceFormat` has a value of '1'. |
| FragmentRefLength | The number of bits that follows this field, which denotes the size of the `FragmentRef` field. |

*Add the following subclause (subclause 8.4.9):*

### 8.4.9 URIFragmentReference

#### 8.4.9.1 Syntax

| URIFragmentReference () { | **Number of bits** | **Mnemonic** |
|---|---|---|
| **href** | FragmentRefLength | bslbf |
| } | | |

#### 8.4.9.2 Semantics

| *Name* | *Definition* |
|---|---|
| href | Defines the URI of the URI fragment reference in UTF-8 format.<br><br>The field is of variable length and its actual length shall be inferred from the `FragmentRefLength` field defined within the `FragmentReference` (see subclause 8.4.8). |

*In subclause 8.5.2.1, add the following definition after the element transitions definition:*

— *Wildcard transitions:* Wildcard transitions, when crossed, specify to the decoder that an undefined element is present in the description.

*In subclause 8.5.2.1, add the following definition after the shunt transitions definition:*

— *Mixed transitions*: Mixed transitions are a special kind of code transitions. Their binary code value is always equal to 1. Mixed transitions, when crossed, specify to the decoder that a string is present between the previous decoded element and the next one.

*In subclause 8.5.2.2.3.1, replace the following text:*

A syntax tree associated to the complex type is generated based on the “reference-free effective content particle” generated in phase 1. The syntax tree associated to the type is composed of different syntax tree nodes: element declaration nodes, group nodes and occurrence nodes. Element declaration nodes associate an element name to its type. They are leaves of the syntax tree and are derived from element declaration particles. Group nodes define a composition group (sequence, choice or all) and are derived from group particles. A group node contains only occurrence nodes. Occurrence nodes are derived from the ‘min occurs’ and ‘max occurs’ property of the particle and contain group nodes or element declaration nodes.

*by*

A syntax tree associated to the complex type is generated based on the “reference-free effective content particle” generated in phase 1. The syntax tree associated to the type is composed of different syntax tree nodes: element declaration nodes, wildcard nodes, group nodes and occurrence nodes. Element declaration nodes associate an element name to its type. Wildcard nodes represent element wildcards. Both element declaration and wildcard nodes are leaves of the syntax tree and are derived respectively from their element declaration and wildcard particles. Group nodes define a composition group (sequence, choice or all) and are

derived from group particles. A group node contains only occurrence nodes. Occurrence nodes are derived from the ‘min occurs’ and ‘max occurs’ property of the particle and contain group nodes, element declaration or wildcard nodes.

*In subclause 8.5.2.2.4, replace the following text:*

Syntax tree normalization gives a unique name to every element declaration node and group node of the syntax tree. It allows to order the sibling nodes and assign a binary code to them. This code is used during the automata construction phase.

*by*

Syntax tree normalization gives a unique name to every element declaration node, wildcard node and group node of the syntax tree. It allows to order the sibling nodes and assign a binary code to them. This code is used during the automata construction phase.

*In subclause 8.5.2.2.4, add the following text after the 3rd bullet (i.e. “Element declaration node signatures are equal to the expanded name of the element”):*

— A wildcard node signature is constructed from the wildcard schema component it is associated to (see XML Schema – Part 1, Chapter 3.10.1) by the concatenation, whitespace separated, of:

  — the “:wildcard” key word

  — the “process contents” property of the wildcard schema component preceded by the character ‘:’ (i.e. “:skip”, “:strict” or “:lax”),

  — the “namespace constraint” property represented by a set of whitespace separated keywords, where

    — the ‘any’, ‘not’ and ‘absent’ values are respectively identified by the “:any”, “:not”, “:absent” keywords,

    — the “:any” or “:not” keywords are always first,

    — the namespaces and, if present the “:absent” keyword, are alphabetically sorted.

*In subclause 8.5.2.2.4, add the following text at the end of the subclause:*

**Wildcard signature example**

Given the following wildcards defined in a schema which target namespace is "http://www.mpeg7.org/example":

```
<xs:any processContents="skip"/>
<xs:any namespace="##other" processContents="lax"/>
<xs:any namespace="urn:example:namespaceB urn:example:namespaceA"/>
<xs:any namespace="##targetNamespace"/>
<xs:any namespace="##local"/>
```