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| |  |  | | --- | --- | | **Title:** | **Preliminary working draft 5 of SEI processing order SEI message in VVC** | | **Source:** | **Convenor (Jens-Rainer Ohm)** | | **Type:** | **Project** | | **Subtype:** | **Draft** | | **Status:** | **Approved** | | **Date:** | **2023-09-02** | | **Expected Action:** | **Info** | | **Action due date:** | **N/A** | | **No. of pages** | **6** (without this cover page) | | **Email of convenor:** | **ohm @ ient . rwth-aachen . de** | | **Committee URL:** | **https://sd.iso.org/documents/ui/#!/browse/iso/iso-iec-jtc-1/iso-iec-jtc-1-sc-29/iso-iec-jtc-1-sc-29-wg-5** | |

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| *Title:* | **SEI processing order SEI message in VVC (draft 5)** | | |
| *Status:* | Output document approved by JVET | | |
| *Purpose:* | Draft text | | |
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| *Source:* | Editors | | |

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# Abstract

This document contains the draft text for changes to the Versatile Video Coding (VVC) standard (Rec. ITU-T H.266 | ISO/IEC 23090-3), to specify the SEI processing order SEI message.

**Changes yet to be integrated:**

none

**Changes that have been integrated:**

Updates from JVET-AE0156. Leave out the change in CVS (for further study), and add a note about the usage of wrapping.

**Changes to the specification text:**

*Replace subclause D.2.1 with the following:*

**D.2.1 General SEI payload syntax**

|  |  |
| --- | --- |
| sei\_payload( payloadType, payloadSize ) { | **Descriptor** |
| SeiExtensionBitsPresentFlag = 0 |  |
| if( nal\_unit\_type = = PREFIX\_SEI\_NUT ) |  |
| if( payloadType = = 0 ) |  |
| buffering\_period( payloadSize ) |  |
| else if( payloadType = = 1 ) |  |
| pic\_timing( payloadSize ) |  |
| else if( payloadType = = 3 ) |  |
| filler\_payload( payloadSize ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| else if( payloadType = = 4 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| user\_data\_registered\_itu\_t\_t35( payloadSize ) |  |
| else if( payloadType = = 5 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| user\_data\_unregistered( payloadSize ) |  |
| else if( payloadType = = 19 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| film\_grain\_characteristics( payloadSize ) |  |
| else if( payloadType = = 45 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| frame\_packing\_arrangement( payloadSize ) |  |
| else if( payloadType = = 47 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| display\_orientation( payloadSize ) |  |
| else if( payloadType = = 56 ) /\* Specified in ISO/IEC 23001-11 \*/ |  |
| green\_metadata( payloadsize ) |  |
| else if( payloadType = = 129 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| parameter\_sets\_inclusion\_indication( payloadSize ) |  |
| else if( payloadType = = 130 ) |  |
| decoding\_unit\_info( payloadSize ) |  |
| else if( payloadType = = 133 ) |  |
| scalable\_nesting( payloadSize ) |  |
| else if( payloadType = = 137 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| mastering\_display\_colour\_volume( payloadSize ) |  |
| else if( payloadType = = 142 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| colour\_transform\_info( payloadSize ) |  |
| else if( payloadType = = 144 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| content\_light\_level\_info( payloadSize ) |  |
| else if( payloadType = = 145 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| dependent\_rap\_indication( payloadSize ) |  |
| else if( payloadType = = 147 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| alternative\_transfer\_characteristics( payloadSize ) |  |
| else if( payloadType = = 148 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| ambient\_viewing\_environment( payloadSize ) |  |
| else if( payloadType = = 149 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| content\_colour\_volume( payloadSize ) |  |
| else if( payloadType = = 150 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| equirectangular\_projection( payloadSize ) |  |
| else if( payloadType = = 153 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| generalized\_cubemap\_projection( payloadSize ) |  |
| else if( payloadType = = 154 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| sphere\_rotation( payloadSize ) |  |
| else if( payloadType = = 155 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| regionwise\_packing( payloadSize ) |  |
| else if( payloadType = = 156 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| omni\_viewport( payloadSize ) |  |
| else if( payloadType = = 165 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| alpha\_channel\_info( payloadSize ) |  |
| else if( payloadType = = 168 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| frame\_field\_info( payloadSize ) |  |
| else if( payloadType = = 177 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| depth\_representation\_info( payloadSize ) |  |
| else if( payloadType = = 179 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| multiview\_acquisition\_info( payloadSize ) |  |
| else if( payloadType = = 180 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| multiview\_view\_position( payloadSize ) |  |
| else if( payloadType = = 200 ) |  |
| sei\_manifest( payloadSize ) |  |
| else if( payloadType = = 201 ) |  |
| sei\_prefix\_indication( payloadSize ) |  |
| else if( payloadType = = 202 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| annotated\_regions( payloadSize ) |  |
| else if( payloadType = = 203 ) |  |
| subpic\_level\_info( payloadSize ) |  |
| else if( payloadType = = 204 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| sample\_aspect\_ratio\_info( payloadSize ) |  |
| else if( payloadType = = 205 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| shutter\_interval\_info( payloadSize ) |  |
| else if( payloadType = = 206 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| extended\_drap\_indication( payloadSize ) |  |
| else if( payloadType = = 207 ) |  |
| constrained\_rasl\_encoding\_indication( payloadSize ) |  |
| else if( payloadType = = 208 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| scalability\_dimension\_info( payloadSize ) |  |
| else if( payloadType = = 209 ) /\* Specified in ISO/IEC 23090-13 \*/ |  |
| vdi\_sei\_envelope( payloadsize ) |  |
| else if( payloadType = = 210 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| nn\_post\_filter\_characteristics( payloadSize ) |  |
| else if( payloadType = = 211 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| nn\_post\_filter\_activation( payloadSize ) |  |
| else if( payloadType = = 212 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| phase\_indication( payloadSize ) |  |
| else if( payloadType = = 213 ) |  |
| sei\_processing\_order( payloadSize ) |  |
| else /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| reserved\_message( payloadSize ) |  |
| else /\* nal\_unit\_type = = SUFFIX\_SEI\_NUT \*/ |  |
| if( payloadType = = 3 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| filler\_payload( payloadSize ) |  |
| else if( payloadType = = 132 ) /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| decoded\_picture\_hash( payloadSize ) |  |
| else if( payloadType = = 133 ) |  |
| scalable\_nesting( payloadSize ) |  |
| else /\* Specified in Rec. ITU-T H.274 | ISO/IEC 23002-7 \*/ |  |
| reserved\_message( payloadSize ) |  |
| if( SeiExtensionBitsPresentFlag | | more\_data\_in\_payload( ) ) { |  |
| if( payload\_extension\_present( ) ) |  |
| **sei\_reserved\_payload\_extension\_data** | u(v) |
| **sei\_payload\_bit\_equal\_to\_one** /\* equal to 1 \*/ | f(1) |
| while( !byte\_aligned( ) ) |  |
| **sei\_payload\_bit\_equal\_to\_zero** /\* equal to 0 \*/ | f(1) |
| } |  |
| } |  |

*In subclause D.2.2, make the following changes:*

...

**Table D.1 – Persistence scope of SEI messages (informative)**

|  |  |
| --- | --- |
| **SEI message** | **Persistence scope** |
| Buffering period | The remainder of the bitstream |
| Picture timing | The AU containing the SEI message |
| DU information | The AU containing the SEI message |
| Scalable nesting | Depending on the scalable-nested SEI messages. Each scalable-nested SEI message has the same persistence scope as if the SEI message was not scalable-nested |
| SEI manifest | The CVS containing the SEI message |
| SEI prefix indication | The CVS containing the SEI message |
| Subpicture level information | The CVS containing the SLI SEI message and up to but not including the next CVS, in decoding order, that contains an SLI SEI message with different content |
| Constrained RASL encoding indication | The CVS containing the SEI message |
| SEI processing order | The CVS containing the SEI message |

...

The list VclAssociatedSeiList is set to consist of the payloadType values 3, 19, 45, 47, 129, 132, 137, 142, 144, 145, 147 to 150, inclusive, 153 to 156, inclusive, 165, 168, 177, 179, 180, 200 to 202, inclusive, and 204 to 213, inclusive.

...

*Add clause D.11 as follows:*

**D.11 SEI processing order SEI message**

D.11.1 SEI processing order SEI message syntax

|  |  |
| --- | --- |
| sei\_processing\_order( payloadSize ) { | **Descriptor** |
| **po\_num\_sei\_messages\_minus2** | u(8) |
| for( i = 0, i < po\_num\_sei\_messages\_minus2 + 2; i++) { |  |
| **po\_sei\_wrapping\_flag**[ i ] | u(1) |
| **po\_sei\_importance\_flag**[ i ] | u(1) |
| if( po\_sei\_wrapping\_flag[ i ] ) { |  |
| **reserved\_alignment\_6bits** | u(6) |
| sei\_message( ) |  |
| } else { |  |
| **po\_sei\_prefix\_flag**[ i ] | u(1) |
| **po\_sei\_payload\_type**[ i ] | u(13) |
| if( po\_sei\_prefix\_flag[ i ]) { |  |
| **po\_num\_prefix\_bytes**[ i ] | b(8) |
| for( j = 0; j < po\_num\_prefix\_bytes[ i ]; j++ ) |  |
| **po\_prefix\_byte**[ i ][ j ] | b(8) |
| } |  |
| } |  |
| **po\_sei\_processing\_order**[ i ] | u(8) |
| } |  |
| } |  |

**D.11.2 SEI processing order SEI message semantics**

The SEI processing order SEI message carries information indicating the preferred processing order, as determined by the encoder (i.e., the content producer), for different types of SEI messages that may be present in a CVS.

When an SEI processing order SEI message is present in any access unit of a CVS, an SEI processing order SEI message shall be present in the first access unit of the CVS. The SEI processing order SEI message persists in decoding order from the current access unit until the end of the CVS. When there are multiple SEI processing order SEI messages present in a CVS, they shall have the same content.

It is a requirement of bitstream conformance that, within an SEI processing order SEI message, there shall be at least two pairs of the syntax elements po\_sei\_payload\_type[ i ] and po\_sei\_processing\_order[ i ], and there shall be at least two values of po\_sei\_processing\_order[ i ] that are not equal.

The SEI processing order SEI message can carry one or more SEI prefix indications of a particular payloadType. Each SEI prefix indication is a byte string that follows the SEI payload syntax of that value of payloadType and contains a number of complete syntax elements starting from the first syntax element in the SEI payload, and may be followed by bits that do not represent any complete syntax element of the SEI payload.

[Ed per JVET-AD0386: Open issues -- Should the SEI prefix be required to consist of a number of complete syntax elements only? If yes, should the SEI prefix length be indicated in bytes or bits?]

These SEI prefix indications should provide sufficient information to determine the specific processing order for SEI messages having the same value of payloadType but different preferred processing order.

**po\_num\_sei\_messages\_minus2** plus 2 indicates the number of SEI messages that have a processing order indicated in the SEI processing order SEI message.

**po\_sei\_importance\_flag**[ i ] indicates the degree of importance determined by the encoder for the SEI message with index i.

If the decoding system cannot interpret or does not support any indicated SEI message that has po\_sei\_importance\_flag[ i ] equal to 1, it should ignore the entire SEI processing order SEI message.

**reserved\_alignment\_6bits** has no meaning and shall be equal to 0 in bitstreams conforming to this version of this Specification. Decoders shall allow this syntax element to have other values and shall ignore the value.

If **po\_sei\_wrapping\_flag**[ i ] is equal to 0, an SEI message should be present outside of the SEI processing order SEI message with payloadType equal to po\_sei\_payload\_type[ i ]. However, if po\_sei\_wrapping\_flag[ i ] is equal to 0 and no SEI message is present with payloadType equal to po\_sei\_payload\_type[ i ], the following applies:

* If po\_sei\_importance\_flag[ i ] is equal to 1, the decoder should ignore the entire SEI processing order SEI message.
* Otherwise, the decoder should ignore all data associated with the loop variable value of i.

NOTE – po\_sei\_wrapping\_flag[ i ] equal to 1 enables SEI messages to be carried within the SEI processing order SEI message to prevent such SEI messages from being incorrectly interpreted by decoders that do not process the SEI processing order SEI message. Thus, po\_sei\_wrapping\_flag[ i ] equal to 1 is intended to be used when po\_sei\_wrapping\_flag[ i ] equal to 0 can lead to unintended results being produced by such decoders.

**po\_sei\_prefix\_flag**[ i ] equal to 1 specifies that po\_num\_prefix\_bytes[ i ] is present. po\_sei\_prefix\_flag[ i ] equal to 0 specifies that po\_num\_prefix\_bytes[ i ] is not present.

**po\_sei\_payload\_type**[ i ] specifies the payloadType value of the i-th SEI message type for which preferred processing order information is provided in the SEI processing order SEI message. For any two different non-negative integer values of m and n, the values of po\_sei\_payload\_type[ m ] and po\_sei\_payload\_type[ n ] shall not be identical unless po\_sei\_prefix\_flag[ m ] and po\_sei\_prefix\_flag[ n ] are both equal to 1.

SeiProcessingOrderSeiList is set to consist of the payloadType values specified in clause D.2.1, except the values 137, 144, 147, 148, 179, 180, 200, 201, 208, and 213. The value of po\_sei\_prefix\_flag[ i ] shall be equal to 0 when po\_sei\_payload\_type[ i ] is not equal to any value among SeiProcessingOrderSeiList.

**po\_num\_prefix\_bytes**[ i ], when present, specifies the number of bytes associated with the i-th SEI message for which preferred processing order information is provided in the SEI processing order SEI message. When not present, the value of po\_num\_prefix\_bytes[ i ] is inferred to be equal to 0.

**po\_prefix\_byte**[ i ][ j ], when present, specifies the j-th byte value of the i-th SEI message.

**po\_sei\_processing\_order**[ i ] indicates the preferred order of processing of the i-th SEI message type for which preferred processing order information is provided in the SEI processing order SEI message. For any two different integer values of m and n that are greater than or equal to 0, po\_sei\_processing\_order[ m ] less than po\_sei\_processing\_order[ n ] indicates any SEI message type with payloadType equal to po\_sei\_payload\_type[ m ] and, when present, bytes po\_prefix\_byte[ m ][ p ] for p ranging from 0 to po\_num\_prefix\_bytes[ m ] − 1, inclusive, should be processed before any SEI message type with payloadType equal to po\_sei\_payload\_type[ n ], and, when present, bytes po\_prefix\_byte[ n ][ q ] for q ranging from 0 to po\_num\_prefix\_bytes[ n ] − 1, inclusive, and po\_sei\_processing\_order[ m ] equal to po\_sei\_processing\_order[ n ] indicates that there is no preferred order of processing between the SEI message types. When there are multiple SEI messages with the same values of po\_sei\_payload\_type[ i ], po\_num\_prefix\_bytes [ i ], and bytes po\_prefix\_ byte[ i ][ j ] for j ranging from 0 to po\_num\_prefix\_bytes [ i ] − 1, inclusive, they shall have the same value of po\_sei\_processing\_order[ i ].

po\_sei\_processing\_order[ 0 ] shall be equal to 0, and for i greater than 0, po\_sei\_processing\_order[ i ] shall be equal to po\_sei\_processing\_order[ i − 1 ] or po\_sei\_processing\_order[ i − 1 ] + 1.

The value of po\_sei\_processing\_order[ po\_num\_sei\_messages\_minus2 + 1 ] shall not be equal to 0.