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| *Title:* | **AHG9: On Scaling List Signalling for SHVC** | | |
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| *Purpose:* | Proposal | | |
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# Abstract

This contribution proposes the syntax and methods for signaling scaling list data in the enhancement layer for SHVC. Due to the similarity between an enhancement layer and its temporal collocated base layer, it is intuitive to derive the enhancement layer scaling list data from the base (or reference) layer scaling list data. Hence, this contribution proposes a few solutions for achieving this purpose, including (1) modifying the semantics of existing syntax elements “sps\_scaling\_list\_data\_present\_flag” and “pps\_scaling\_list\_data\_present\_flag”; (2) introducing new syntax elements “sps\_base\_pred\_scaling\_list\_flag” and ““pps\_base\_pred\_scaling\_list\_flag” to existing SPS and PPS syntax; (3) modifying the semantics of existing syntax element “scaling\_list\_pred\_matrix\_id\_delta”; and (4) introducing new syntax element “base\_pred\_scaling\_list\_flag” to scaling list data syntax. Besides, inter-layer scaling list prediction for the size 16x16 and 32x32 is not allowed if the reference layer is the base layer and the value of avc\_base\_layer\_flag in vps\_extension() is 1. Furthermore, it is proposed to apply Inter scaling list data on blocks that are inter-layer texture predicted.

Introduction

In the prior art SVC (scalable video coding) standard as well as the current SHVC/SHM, the scaling list (quantization matrix) data derivation and signalling are independent in each spatial or quality layer. However due to the high correlations among different spatial and quality layers with the same time stamp, it is intuitive to apply the same scaling list data on those temporal collocated spatial and quality layers. Therefore, this contribution proposes several solutions for deriving and signalling scaling list data of an enhancement (higher) layer from the base (reference) layer such that some redundancies from signalling scaling list information as in the prior art standard can be removed.

# Proposed syntax and semantics

Four solutions are proposed to achieve the goal of deriving the enhancement layer scaling list data from temporal collocated base (reference) layer scaling list data.

In the proposed method 1, the semantic descriptions of enhancement layer syntax elements are modified as follows.

* **sps\_scaling\_list\_data\_present\_flag** equal to 1 specifies that scaling list data are present in the sequence parameter set. sps\_scaling\_list\_data\_present\_flag equal to 0 specifies that scaling list data are not present in the sequence parameter set. When not present, the value of sps\_scaling\_list\_data\_present\_flag is inferred to be equal to 0. When scaling\_list\_enabled\_flag is equal to 1 and sps\_scaling\_list\_data\_present\_flag is equal to 0,

when nuh\_layer\_id equal to 0, or when nuh\_layer\_id is greater than 0 and sizeID is 2 or 3, the reference layer is base layer and the value avc\_base\_layer\_flag in vps\_extension() is 1, the default scaling list data is used to derive the array ScalingFactor as described in the scaling list data semantics specified in subclause 7.4.5.

Otherwise, scaling list data of the reference layer is used to derive the array ScalingFactor. The reference layer can be the immediate lower layer or the base layer, or indicated by a reference\_layer\_id.

* **pps\_scaling\_list\_data\_present\_flag** equal to 1 specifies that parameters are present in the picture parameter set to modify the scaling lists specified in the active sequence parameter set. pps\_scaling\_list\_data\_present\_flag equal to 0 specifies that the scaling lists used for the pictures referring to the picture parameter set is inferred to be equal to those specified by the active sequence parameter set. When scaling\_list\_enabled\_flag is equal to 0, the value of pps\_scaling\_list\_data\_present\_flag shall be equal to 0. When scaling\_list\_enabled\_flag is equal to 1, sps\_scaling\_list\_data\_present\_flag is equal to 0, and pps\_scaling\_list\_data\_present\_flag is equal to 0,

when nuh\_layer\_id equal to 0, or when nuh\_layer\_id is greater than 0 and sizeID is 2 or 3, the reference layer is base layer and the value avc\_base\_layer\_flag in vps\_extension() is 1, the default scaling list data is used to derive the array ScalingFactor as described in the scaling list data semantics specified in subclause 7.4.5.

Otherwise, scaling list data of the reference layer is used to derive the array ScalingFactor. The reference layer can be the immediate lower layer or the base layer, or indicated by a reference\_layer\_id.

In the proposed method 2, a new syntax element “**sps\_base\_pred\_scaling\_list\_flag**” is introduced to SPS and a syntax element “**pps\_base\_pred\_scaling\_list\_flag**” is introduced to PPS of the higher (or enhancement) layers with nuh\_layer\_id greater than 0. The added syntax and semantics are as follows.

|  |  |
| --- | --- |
| seq\_parameter\_set\_rbsp( ) { | Descriptor |
| ... ... |  |
| scaling\_list\_enabled\_flag | u(1) |
| if( scaling\_list\_enaled\_flag ) { |  |
| **sps\_scaling\_list\_data\_present\_flag** | u(1) |
| if( sps\_scaling\_list\_data\_present\_flag ) |  |
| **sps\_base\_pred\_scaling\_list\_flag** | u(1) |
| if( !sps\_base\_pred\_scaling\_list\_flag ) |  |
| scaling\_list\_data( ) |  |
| } |  |
| ... ... |  |
| rbsp\_trailing\_bits( ) |  |
| } |  |

* **sps\_base\_pred\_scaling\_list\_flag** is signalled if sps\_scaling\_list\_data\_present\_flag is equal to 1. sps\_base\_pred\_scaling\_list\_flag equal to 1 specifies that the scaling list data is inferred from the scaling list data in the reference layer sequence parameter set. sps\_base\_pred\_scaling\_list\_flag equal to 0 specifies that scaling list data present in the sequence parameter set. The value shall be 0 if the reference layer is the base layer and the value avc\_base\_layer\_flag in vps\_extension() is 1. When not present, the value is inferred to be 0.

|  |  |
| --- | --- |
| pic\_parameter\_set\_rbsp( ) { | Descriptor |
| ... ... |  |
| **pps\_scaling\_list\_data\_present\_flag** | u(1) |
| if( pps\_scaling\_list\_data\_present\_flag ) |  |
| **pps\_base\_pred\_scaling\_list\_flag** | u(1) |
| if( !pps\_base\_pred\_scaling\_list\_flag ) |  |
| scaling\_list\_data( ) |  |
| } |  |
| ... ... |  |
| rbsp\_trailing\_bits( ) |  |
| } |  |

* **pps\_base\_pred\_scaling\_list\_flag** is signalled if pps\_scaling\_list\_data\_present\_flag is equal to 1. pps\_base\_pred\_scaling\_list\_flag equal to 1 specifies that the scaling list data is inferred from the scaling list data in the reference layer picture parameter set. pps\_base\_pred\_scaling\_list\_flag equal to 0 specifies that scaling list data present in the sequence parameter set. The value shall be 0 if the reference layer is the base layer and the value of avc\_base\_layer\_flag in vps\_extension() is 1. When not present, the value is inferred to be 0.

In the proposed method 3, the semantics of the syntax element “**scaling\_list\_pred\_matrix\_id\_delta”** in scaling list data syntax is modified, as follows. (highlighted in yellow)

* **scaling\_list\_pred\_matrix\_id\_delta**[ sizeId ][ matrixId ] specifies the reference scaling list used to derive ScalingList[ sizeId ][ matrixId ] as follows:

– If scaling\_list\_pred\_matrix\_id\_delta is equal to 0, the scaling list is inferred from the default scaling list ScalingList[ sizeId ][ matrixId ][ i ] as specified in Table 7‑5 and Table 7‑6 for i = 0..Min( 64, ( 1  <<  ( 4 + ( sizeId  <<  1 ) ) ) ) when nuh\_layer\_id is equal to 0 (i.e. base layer.) When nul\_layer\_id is greater than 0 (i.e. enhancement layer,) the scaling list is inferred from the reference layer scaling list ScalingList[ sizeId ][ matrixId ][ i ] for i = 0..Min( 64, ( 1  <<  ( 4 + ( sizeId  <<  1 ) ) ) )

– Otherwise, the scaling list is inferred from the reference scaling list as follows: ...

In the proposed method 4, a new syntax element “**base\_pred\_scaling\_list\_flag**” is introduced to scaling list data syntax. The syntax and semantics are described as follows.

|  |  |
| --- | --- |
| scaling\_list\_data( ) { | Descriptor |
| for( sizeId = 0; sizeId < 4; sizeId++ ) |  |
| for( matrixId = 0; matrixId < ( ( sizeId = = 3 ) ? 2 : 6 ); matrixId++ ) { |  |
| **scaling\_list\_pred\_mode\_flag**[ sizeId ][ matrixId ] | u(1) |
| if( !scaling\_list\_pred\_mode\_flag[ sizeId ][ matrixId ] ) |  |
| **base\_pred\_scaling\_list\_flag** | u(1) |
| **scaling\_list\_pred\_matrix\_id\_delta**[ sizeId ][ matrixId ] | ue(v) |
| else { |  |
| nextCoef = 8 |  |
| coefNum = Min( 63~~64~~, ( 1  <<  ( 4 + ( sizeId  <<  1 ) ) ) - 1 ) |  |
| ... ... |  |
| } |  |
| } |  |
| } |  |

* **base\_pred\_scaling\_list\_flag** is signalled if **scaling\_list\_pred\_mode\_flag** is equal to 0. base\_pred\_scaling\_list\_flag equal to 1 specifies the reference scaling list used to derive ScalingList[ sizeId ][ matrixId ] is from a reference layer. base\_pred\_scaling\_list\_flag equal to 1 specifies the reference scaling list used to derive ScalingList[ sizeId ][ matrixId ] is from the same layer. The value shall be 0 if the value of sizeId shall be 2 or 3, the reference layer is the base layer, and the value of avc\_base\_layer\_flag in vps\_extension() is 1.

In single layer video coding there are two types of predictions, i.e. Intra prediction and Inter prediction. When a block is Intra predicted, Intra scaling list with the corresponding size and colour space is applied. When a block is Inter predicted, Inter scaling list with the corresponding size and color space is applied. In scalable video coding, there is another prediction mode, i.e. inter-layer texture prediction mode (or “Intra\_BL” mode in prior art standard.) In this contribution we propose to treat this mode the same as Inter prediction mode. That is, if a block is inter-layer texture predicted, Inter scaling list with the corresponding size and color space is applied.

# Patent rights declaration(s)

**MediaTek Inc. may have IPR relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**

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