

JCTVC-N0216/JCT3V-E0096 ON REFERENCE PICTURE LIST MODIFICATION

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Introduction

- RPLM is mainly used to relocate inter-layer reference pictures for CTC cases
- The relative position of temporal reference pictures are not changed
- Every entry of ref list needs to be signaled
- Proposed inter-layer reference picture set position indication to save RPLM bits
- Similar decoding process as JCTVC-N0095, but different syntax signaling.

Proposed RPLM syntax

	Descriptor
ref_pic_lists_modification() {	
ref_pic_list_modification_flag_l0	u(1)
if(ref_pic_list_modification_flag_l0)	
if (nuh_layer_id > 0 && InterRefEnabledInRPLFlag) {	
ilrps_l0_modification_only_flag	u(1)
if (ilrps_l0_modification_only_flag)	
list_l0_ilrps_position	u(v)
}	
if (ilrp_l0_modification_only_flag == 0)	
for(i = 0; i <= num_ref_idx_l0_active_minus1; i++)	
list_entry_l0[i]	u(v)
if(slice_type == B) {	
ref_pic_list_modification_flag_l1	u(1)
if(ref_pic_list_modification_flag_l1)	
if (nuh_layer_id > 0 && InterRefEnabledInRPLFlag) {	
ilrps_l1_modification_only_flag	u(1)
if (ilrps_l1_modification_only_flag)	
list_l1_ilrps_position	u(v)
}	
if (ilrps_l1_modification_only_flag == 0)	
for(i = 0; i <= num_ref_idx_l1_active_minus1; i++)	
list_entry_l1[i]	u(v)
}	
}	

Proposed RPLM semantics

- **ilrps_l0_modification_only_flag** equal to 1 indicates that reference picture list 0 is specified explicitly by list_l0_ilrps_position values. ilrps_l0_modification_only_flag equal to 0 indicates that reference picture list 0 is specified explicitly by a list of list_entry_l0[i] values. When ilrps_l0_modification_only_flag is not present in the slice header, it is inferred to be equal to 0.
- **list_l0_ilrps_position** specifies the beginning position of the inter-layer reference picture set in refPicListTemp0. The length of the list_l0_ilrps_position syntax element is $\text{Ceil}(\text{Log2}(\text{num_ref_idx_l0_active_minus1}+1))$ bits. The value of list_l0_ilrps_position shall be in the range of 0 to num_ref_idx_l0_active_minus1, inclusive. When the syntax element list_l0_ilrps_position is not present in the slice header, it is inferred to be equal to 0.
- **ilrps_l1_modification_only_flag** equal to 1 indicates that reference picture list 1 is specified explicitly by list_l1_ilrps_position values. ilrps_l1_modification_only_flag equal to 0 indicates that reference picture list 0 is specified explicitly by a list of list_entry_l1[i] values. When ilrps_l1_modification_only_flag is not present in the slice header, it is inferred to be equal to 0.
- **list_l1_ilrps_position** specifies the beginning position of the inter-layer reference picture set in refPicListTemp0. The length of the list_l1_ilrps_position syntax element is $\text{Ceil}(\text{Log2}(\text{num_ref_idx_l1_active_minus1}+1))$ bits. The value of list_l1_ilrps_position shall be in the range of 0 to num_ref_idx_l1_active_minus1, inclusive. When the syntax element list_l1_ilrps_position is not present in the slice header, it is inferred to be equal to 0.

Proposed RPLM decoding process

The variable NumRpsCurrTempList0 is set equal to $\text{Max}(\text{num_ref_idx_10_active_minus1} + 1, \text{NumPocTotalCurr})$ and the list RefPicListTemp0 is constructed as follows:

```

rIdx = 0
while( rIdx < NumRpsCurrTempList0 - NumActiveRefLayerPics ) {
    if( InterRefEnabledInRPLFlag ) {
        for( i = 0; i < NumPocStCurrBefore && rIdx < NumRpsCurrTempList0; rIdx++, i++ )
            RefPicListTemp0[ rIdx ] = RefPicSetStCurrBefore[ i ]
        for( i = 0; i < NumPocStCurrAfter && rIdx < NumRpsCurrTempList0; rIdx++, i++ )
            RefPicListTemp0[ rIdx ] = RefPicSetStCurrAfter[ i ]
        for( i = 0; i < NumPocLtCurr && rIdx < NumRpsCurrTempList0; rIdx++, i++ )
            RefPicListTemp0[ rIdx ] = RefPicSetLtCurr[ i ]
    }
    for( i = 0; i < NumActiveRefLayerPics; rIdx++, i++ )
    RefPicListTemp0[ rIdx ] = RefPicSetInterLayer[ i ]
}
if( ilrps_10_modification_only_flag )
{
    for( i = NumRpsCurrTempList0 - 1; i >= list_10_ilrps_position + NumActiveRefLayerPics; i -- )
        RefPicListTemp0[ i ] = RefPicListTemp0[ i - NumActiveRefLayerPics ]
    for( i = 0; i < NumActiveRefLayerPics; i++ )
        RefPicListTemp0[ list_10_ilrps_position + i ] = RefPicSetInterLayer[ i ]
}

```

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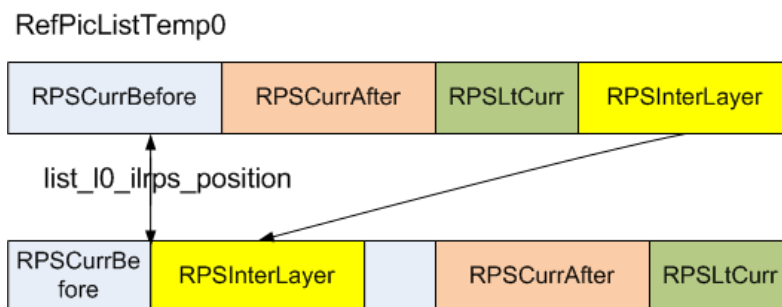
The list RefPicList0 is constructed as follows:

```

for( rIdx = 0; rIdx <= num_ref_idx_10_active_minus1; rIdx++ )
    RefPicList0[ rIdx ] = ref_pic_list_modification_flag_10 ? RefPicListTemp0[ list_entry_10[ rIdx ] ] :
                                                                RefPicListTemp0[ rIdx ]

```

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Bit counting results

RPLM bits comparison (SHM2.0, RA)

Sequences	Intra Period	Total frames	Anchor (bit)	N0216 (bit)	Bit saving percentage
Kimono1 ParkScene	24	240	3832	1654	56.84%
PeopleOnStreet Traffic	32	150	2394	1032	56.89%
BasketballDrive Cactus	48	500	8214	3510	57.27%
BQTerrace	64	600	9952	4264	57.15%

RPLM bits comparison (HTM-Dev-0.1, RA)

	Intra Period	Total frames	Coding structure	Anchor (bit)	N0216 (bit)	Bit saving percentage
MV-HEVC	25	250	PIP (3t)	4930	2378	51.76%
3D-HEVC	25	250	PIP (3t + 3d)	9860	4756	51.76%

Conclusion

- Indication is proposed to add in RPLM to signal inter-layer RPS position
- RPLM bits saving is above 50% for both SHVC and MV/3D-HEVC
- Suggest to adopt in SHVC and MV-HEVC