



JCTVC-D127

Syntax for Leaf CU Aligned Slices

Chih-Wei Hsu, Chia-Yang Tsai, Yu-Wen Huang, and
Shawmin Lei

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Overall Summary

- A syntax design that can support both LCU-aligned and leaf-CU-aligned slices is proposed
 - When supporting LCU-aligned slices, the coding performance is similar to the LCU-aligned slices designed by slice AHG
 - When supporting leaf-CU-aligned slices, it can have more accurate rate control
 - When 1500 bytes per slice is considered
 - bitrate inaccuracies of LCU-aligned slices are 5%-14%
 - bitrate inaccuracies of leaf-CU-aligned slices are only 1%-3%
 - Our syntax design
 - Use hierarchical method to specify the start address of slice
 - Use hierarchical method to denote the termination of slices when CABAC is considered
- A software supporting this syntax design is verified and available

Outlines

- Introduction
- Proposed slice
- Simulation results
- Conclusions

Introduction: Problem Definitions

- In HM, only one slice per picture can be supported
 - Necessary to add the feature of multiple slices per picture
- In HEVC WD, slices can only be partitioned on LCU resolution
 - Should allow slice partitioning with smaller units
 - Better for rate control applications such as “near-fixed number of bits per slice”
- So we implement a software based on TMuC0.9 that can support both LCU aligned and leaf CU aligned slices

Proposed Slice Categories

- lcu_aligned_slice_flag is added to SPS
- entropy_coding_mode_flag is signaled at slice header
- 4 cases depend on whether slice boundaries are LCU aligned and whether CABAC is used

Case	1	2	3	4
LCU Aligned (True: lcu_aligned_slice_flag = 1)	True	True	False	False
CABAC (True: entropy_coding_mode_flag = 1)	False	True	False	True

Case 1: LCU-Aligned, LCEC (Slice AHG Syntax)

LCU00	LCU01	LCU02	LCU03	LCU04	LCU05
LCU06	LCU07	LCU08	LCU09	LCU10	LCU11
LCU12	LCU13	LCU14	LCU15	LCU16	LCU17
LCU18	LCU19	LCU20	LCU21	LCU22	LCU23

Slice 0

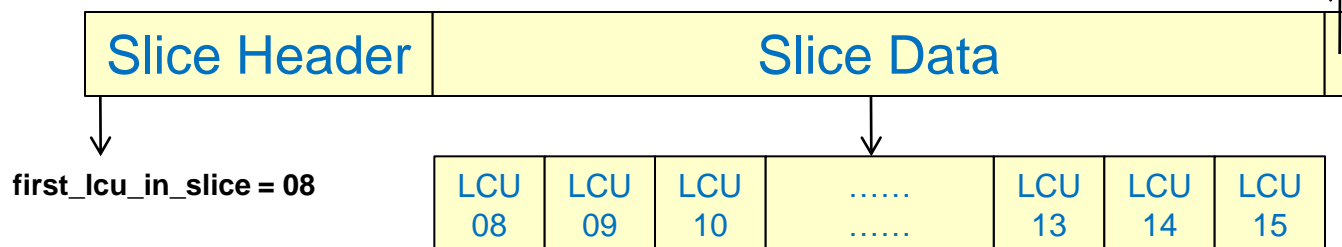
Slice 1

Slice 2

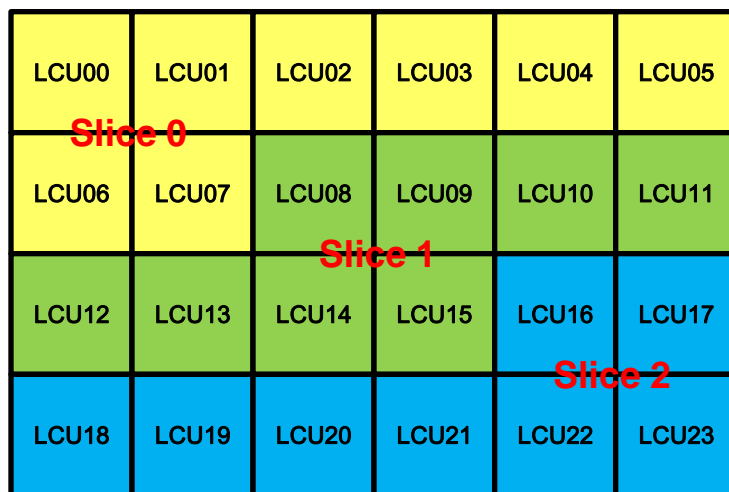
Take Slice 1 as an Example

RBSP Slice Trailing Bits

1+000... to byte alignment



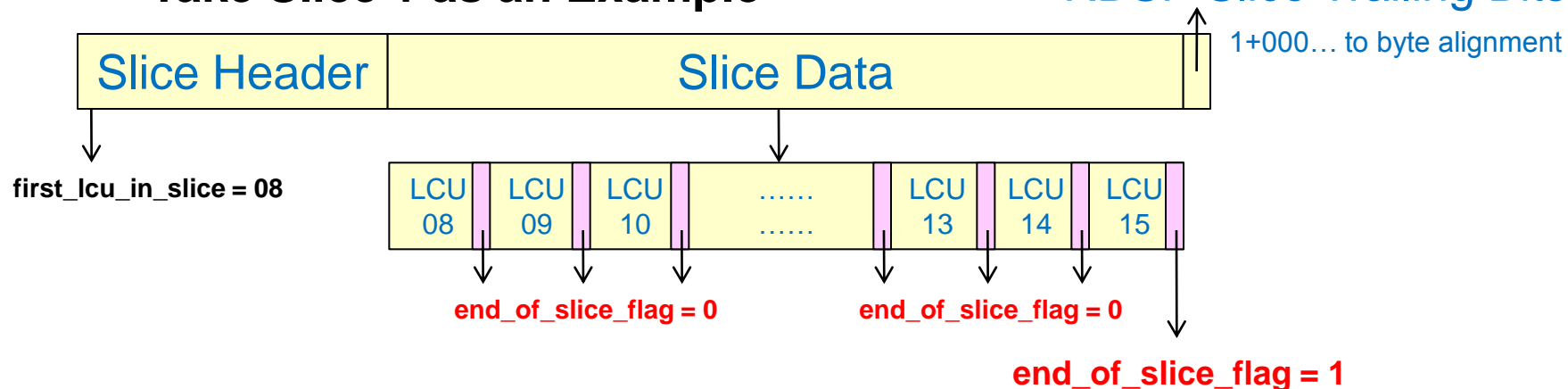
Case 2: LCU-Aligned, CABAC (Slice AHG Syntax)



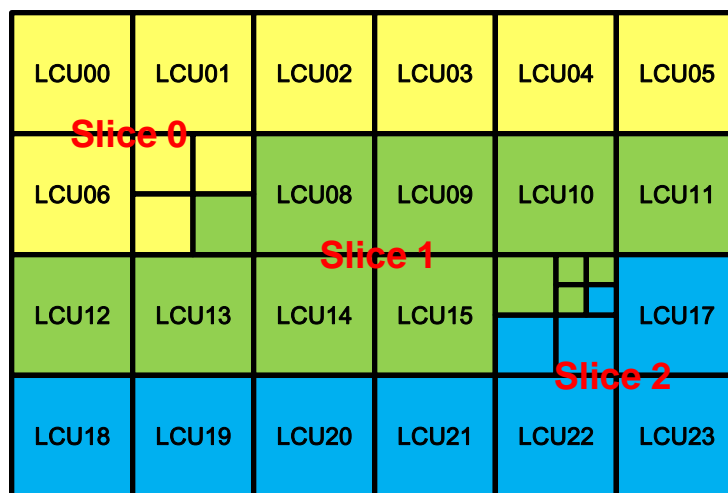
Take Slice 1 as an Example

RBSP Slice Trailing Bits

1+000... to byte alignment



Case 3: Leaf-CU-Aligned, LCEC



0	1	4	5	16	17	20	21
2	3	6	7	18	19	22	23
8	9	12	13	24	25	28	29
10	11	14	15	26	27	30	31
32	33	36	37	48	49	52	53
34	35	38	39	50	51	54	55
40	41	44	45	56	57	60	61
42	43	46	47	58	59	62	63

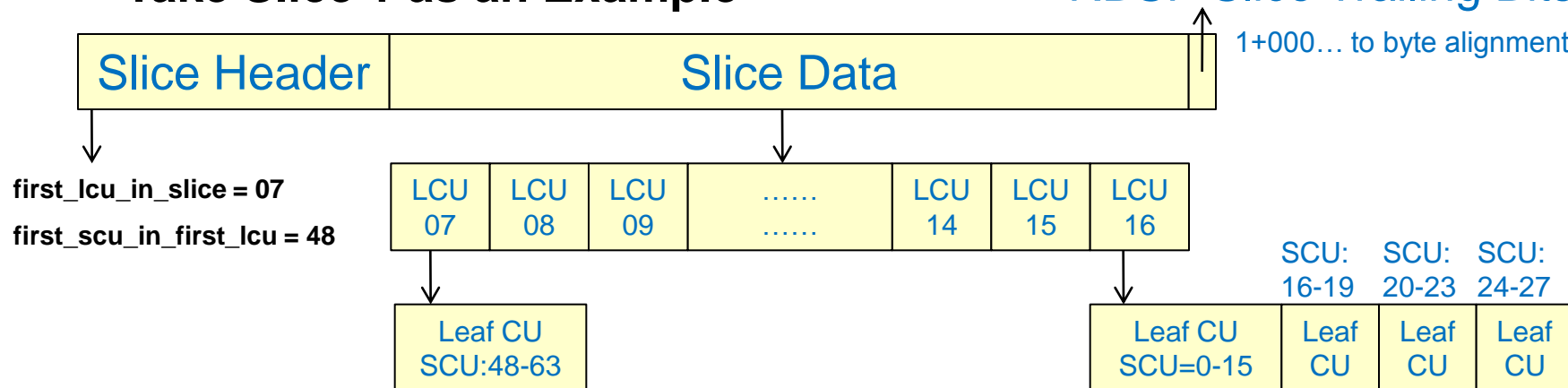
→ LCU

LCU size: 64x64
SCU size : 8x8

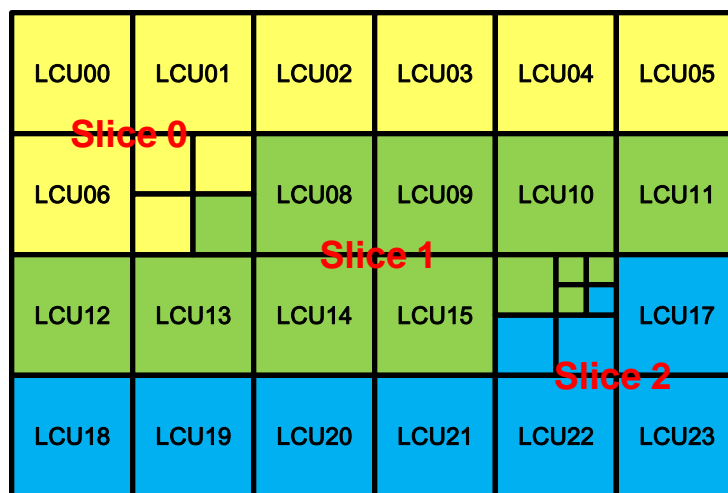
These numbers
denote SCU
indices.

Take Slice 1 as an Example

RBSP Slice Trailing Bits



Case 4: Leaf-CU-Aligned, CABAC



0	1	4	5	16	17	20	21
2	3	6	7	18	19	22	23
8	9	12	13	24	25	28	29
10	11	14	15	26	27	30	31
32	33	36	37	48	49	52	53
34	35	38	39	50	51	54	55
40	41	44	45	56	57	60	61
42	43	46	47	58	59	62	63

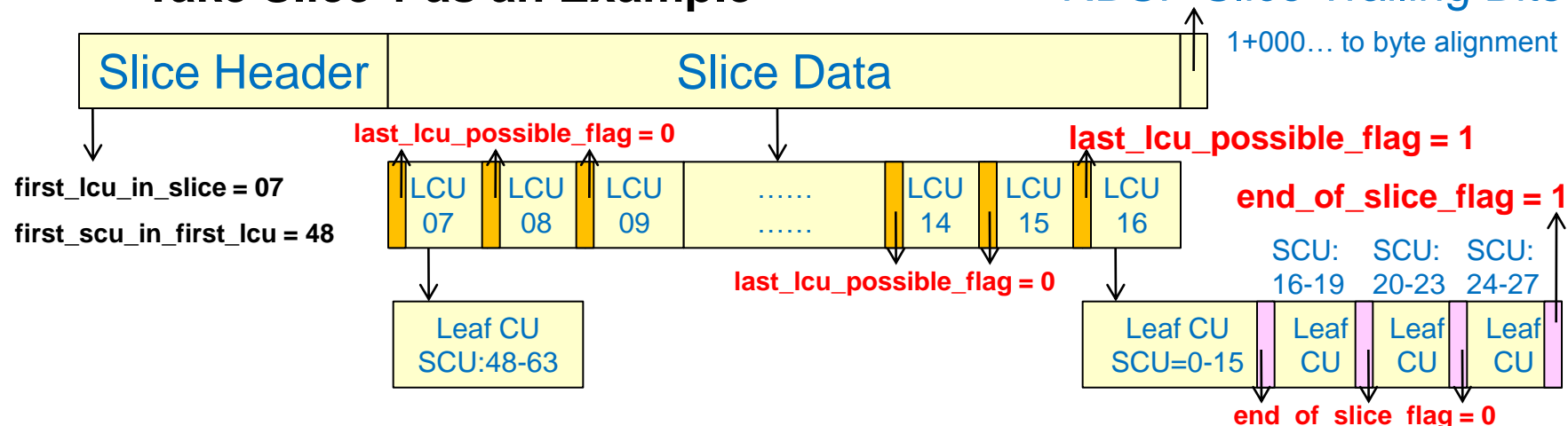
→ LCU

LCU size: 64x64
SCU size : 8x8

These numbers
denote SCU
indices.

Take Slice 1 as an Example

RBSP Slice Trailing Bits



Transmit one end_of_slice_flag for every leaf CU of the LCU with last_lcu_possible_flag=1.

Simulation Results

- To support fully independent or parallel decoding of multiple slices
 - Slice-independent DF and ALF are implemented
- The modified DF and ALF will suffer a little coding efficiency loss (0.1%-0.4%)
 - Since the ALF issue is not the focus of this proposal, ALF is turned off for all experiments
 - This will only affect the HE anchors because ALF is already off in LC configurations of JCTVC-C500

Fixed number of LCUs per slice

- Slice settings:
 - Slice mode: fixed LCU number
 - Number of LCUs per slice:
 - “the number of LCUs of the picture width plus one”
 - lcu_aligned_slice_flag: true
- Anchor: JCTVC-C500 (ALF off)



BD-rate (%)	HE-AI	LC-AI	HE-RA	LC-RA	HE-LD	LC-LD
Mediatek Slice	3.9	4.3	7.7	6.5	9.1	6.2
Slice AHG	3.5	4.0	7.3	6.3	8.7	6.2

Fixed number of bytes per slice

- Slice settings:
 - Slice mode: fixed number of bytes
 - Number of bytes per slice: 1500
 - lcu_aligned_slice_flag: true vs. false

- Performance matrix:
$$inaccuracy(\%) = \left| \frac{(\text{Real coded bytes} - \text{Target bytes})}{\text{Target bytes}} \times 100 \right|$$

inaccuracy (%)	HE-AI	LC-AI	HE-RA	LC-RA	HE-LD	LC-LD
LCU-aligned slice	13.56	14.48	8.75	8.90	6.06	4.98
Leaf CU-aligned slice	1.91	0.61	2.17	0.66	2.81	0.70

Cross Verification

- We thank Ericsson for crosschecking our proposal
 - JCTVC-D387
 - Our software can be compiled and ran without any problems
 - BD-rates data are confirmed

Conclusions

- A syntax design that can support both LCU-aligned and leaf-CU-aligned slices is proposed
 - The coding performance of LCU-aligned slice is similar to that of slice AHG
 - Our syntax design can have more accurate rate control
- It is proposed to adopt the flexible slice syntax design



Thank you

