

# CE1: Subset A: Parallel context processing for coefficient coding using block-based context updates

*Hisao Sasai*

*Takahiro Nishi*

**Panasonic Corporation**

**Panasonic** ideas for life

## #Target

- To reduce the dependency from context updates within TU

## #Solution

- BBCU (Block based context updates) for coefficient coding parameters
- Context updates are operated, but not reflected to current Block operation.  
(same computational cost within the loop)
- To update the probabilities at the end of block encoding/decoding.

## #Results

- less than 0.1% drop for all configuration (without significant map)  
with 50% worst case cycle reduction ( coefficient levels)

## # Cross-Checking

Done by MediaTek

## Motivation

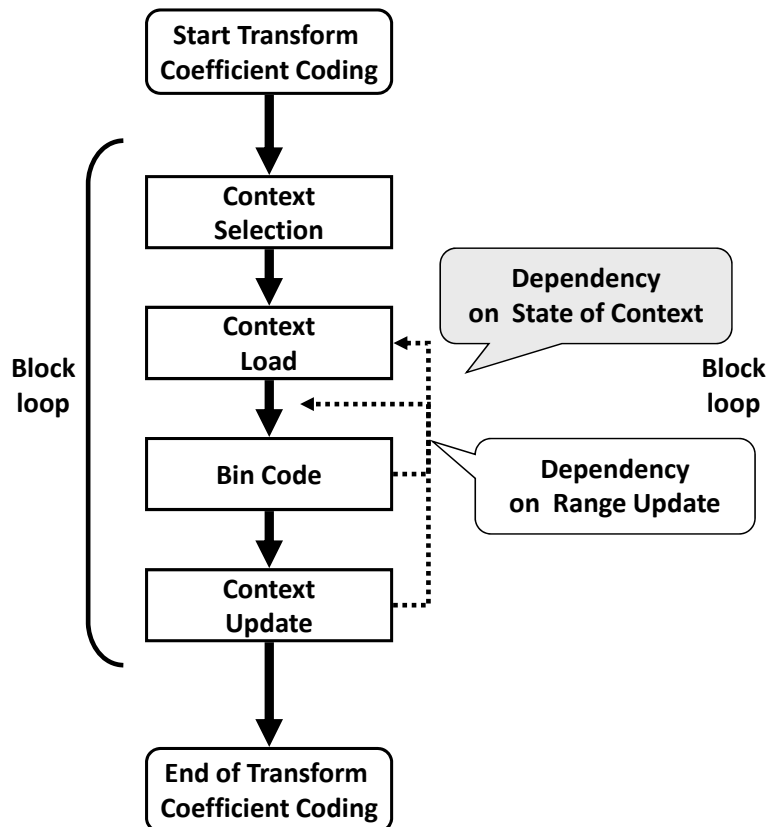
**CABAC feedback loop is one of main issue for parallel processing due to high serial dependency.**

**In current HEVC CABAC, same contex index is used continuously.**

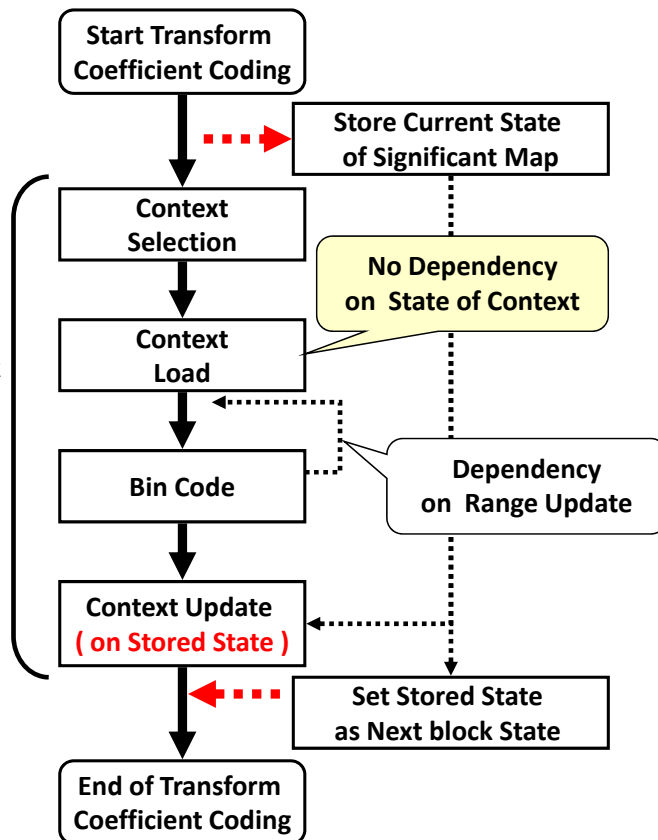
**e.g, significant\_coeff\_flag in high frequency, last\_flag...**

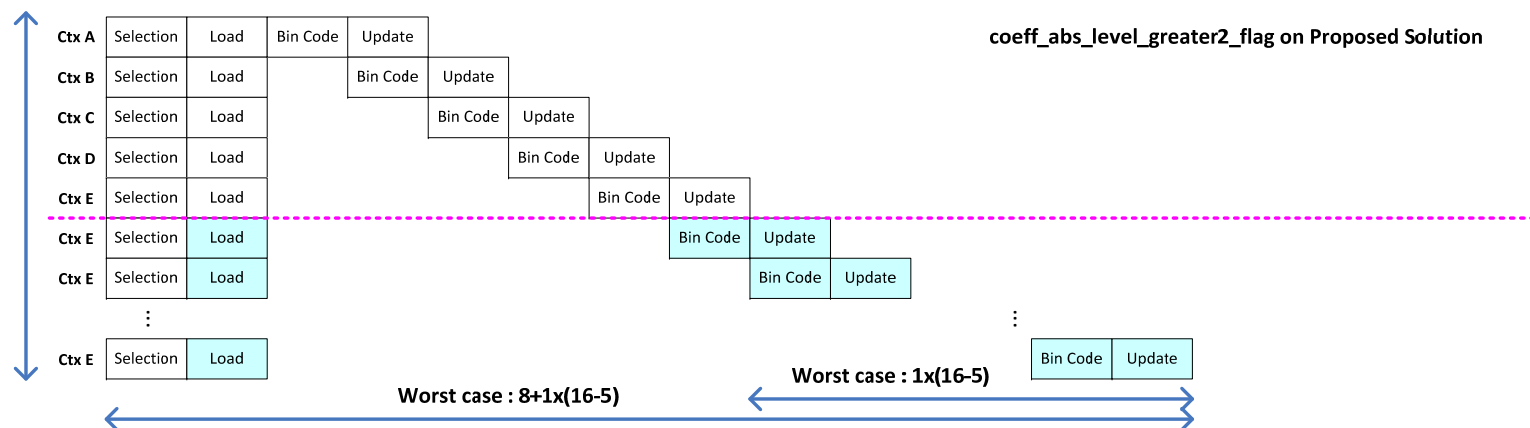
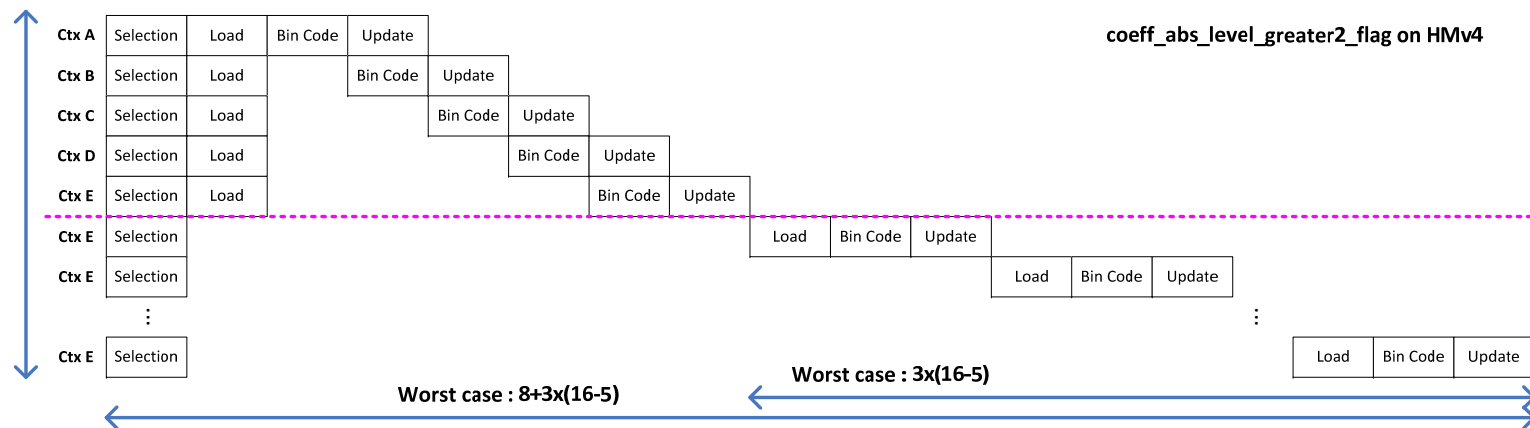
**→ Block-based context updates brings possibility of parallel processing  
with limited performance drop.**

## Current HEVC CABAC



## Proposed Solution





The number of cycles in the worst case for coefficient coding parameters

		HMv4	BBCU	Reduction Ratio
last_significant_coeff_x/y	4x4	6	6	0.0%
	8x8	10	8	20.0%
	16x16	17	13	23.5%
	32x32	40	22	45.0%
significant_coeff_flag	4x4	18	18	0.0%
	8x8	128	66	48.4%
	16x16	758	259	65.8%
	32x32	3062	1027	66.5%
coeff_abs_level_greater1_flag	4x4	49	19	61.2%
coeff_abs_level_greater2_flag	4x4	41	19	53.7%

## BD-Rate

TEST 1. All coefficient coding parameters

TEST 2. All coefficient coding parameters except for "significant\_coeff\_flag"

TEST 3. "last\_significant\_coeff\_x" and "last\_significant\_coeff\_y"

TEST 4. "coeff\_abs\_level\_greater1\_flag" and "coeff\_abs\_level\_greater2\_flag"

TEST 5. "significant\_coeff\_flag"

The summary of those test are listed in Table 2. The detail results are available in excel sheet.

**Table 1. BD BR for summary results**

	All Intra HE			Random Access HE			Low delay B HE			Low delay P HE		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
<b>TEST1</b>	0.2%	0.3%	0.3%	0.1%	0.1%	0.0%	0.1%	-0.1%	0.0%	0.1%	-0.2%	-0.2%
<b>TEST2</b>	0.1%	0.1%	0.1%	0.0%	0.0%	-0.1%	0.0%	-0.2%	-0.1%	0.0%	-0.1%	-0.3%
<b>TEST3</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>TEST4</b>	0.1%	0.1%	0.1%	0.0%	0.1%	-0.1%	0.0%	-0.2%	0.0%	0.0%	0.0%	-0.1%
<b>TEST5</b>	0.1%	0.2%	0.2%	0.1%	0.2%	0.1%	0.1%	-0.1%	0.1%	0.1%	0.2%	-0.1%

## Our proposal method

(BBCU for transform coding parameters except for significant coeff flag)  
provides additional possibility of parallel processing  
with less than 0.1% drop.

It is suggested to consider the inclusion of this proposal  
in the HM/WD of HEVC for the future deployment of  
the standard.