



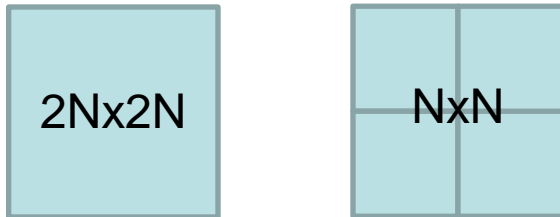
Remove Partition Size NxN

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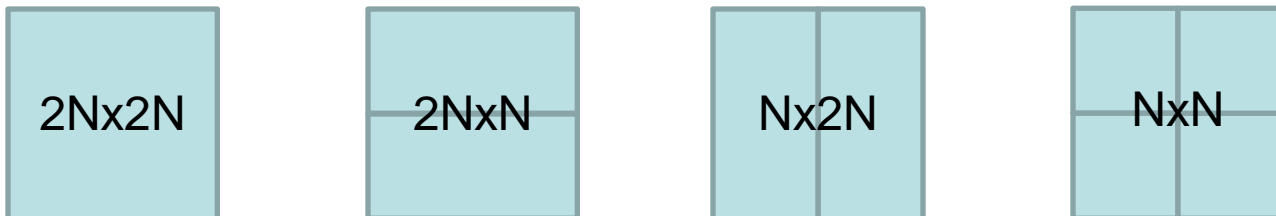


Partition Sizes in TMuC0.9 (HM)

- INTRA

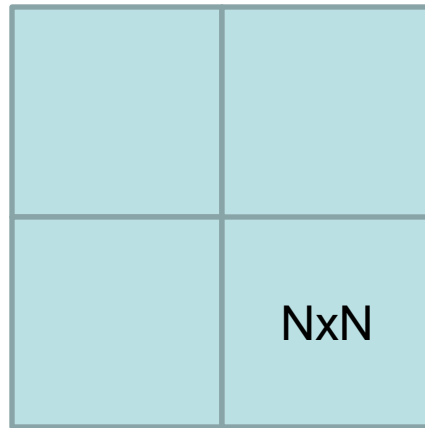


- INTER

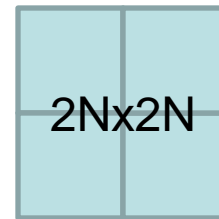


Partition Sizes in TMuC0.9 (HM)

- Possible redundancies
 - Prediction size for a CU with SIZE_NxN in depth(k) is same as prediction size for a CU with SIZE_2Nx2N in depth(k+1)



depth = k



depth = k+1

Proposed CU Syntax Modification

Part_Size in TMuC (HM)

| Inter Slice (Picture) Inter Prediction | |
|--|-----------|
| 2Nx2N | 1 |
| 2NxN | 0 1 1 |
| 2NxN _U | 0 1 0 0 |
| 2NxN _D | 0 1 0 0 |
| Nx2N | 0 0 1 1 |
| nLx2N | 0 0 1 0 0 |
| nLx2N | 0 0 1 0 1 |
| NxN | 0 0 0 1 |
| Inter Slice (Picture) Intra Prediction | |
| 2Nx2N | 0 0 0 0 0 |
| NxN | 0 0 0 0 1 |
| Intra Slice (Picture) Intra Prediction | |
| 2Nx2N | 1 |
| NxN | 0 |

Part_Size, proposed

| Inter Slice (Picture) Inter Prediction | |
|--|-----------|
| 2Nx2N | 1 |
| 2NxN | 0 1 1 |
| 2NxN _U | 0 1 0 0 |
| 2NxN _D | 0 1 0 0 |
| Nx2N | 0 0 1 1 |
| nLx2N | 0 0 1 0 0 |
| nLx2N | 0 0 1 0 1 |
| | |
| Inter Slice (Picture) Intra Prediction | |
| 2Nx2N | 0 0 0 |
| | |
| Intra Slice (Picture) Intra Prediction | |
| 2Nx2N | |
| | |

Allow Partition Size NxN for SCU

- INTRA prediction
 - Mandatory
- INTER prediction
 - Optional

Test Condition

- Codebase TMuC0.9 (HM)
- Compare proposed methods with TMuC0.9 (HM) anchors
 - High efficiency
 - Low complexity (*)
- Computing platform
 - Linux, 64bit, Intel Xeon E5160, memory up to 16GB.
- Measurement
 - Encoding and decoding time (%)
 - BD-Rate (%)

Results (1, NxN exists in SCU only)

| | Intra | | | Intra LoCo | | |
|-------------|---------------|-----------|-----------|--------------------|-----------|-----------|
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.3 | 0.5 | 0.7 | 1.1 | -0.3 | -0.4 |
| Class B | 0.2 | 0.3 | 0.4 | 1.1 | -0.3 | -0.3 |
| Class C | 0.2 | 0.2 | 0.3 | 0.6 | -0.1 | -0.1 |
| Class D | 0.1 | 0.1 | 0.1 | 0.4 | -0.2 | -0.1 |
| Class E | 0.3 | 0.7 | 0.7 | 1.8 | -1.1 | -0.6 |
| All | 0.2 | 0.3 | 0.4 | 0.9 | -0.4 | -0.3 |
| Enc Time[%] | 72% | | | 66% | | |
| Dec Time[%] | 98% | | | 101% | | |
| | | | | | | |
| | Random access | | | Random access LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.2 | 0.2 | 0.2 | 0.8 | -0.9 | -1.1 |
| Class B | 0.2 | 0.2 | 0.2 | 0.7 | -0.5 | -0.3 |
| Class C | 0.2 | 0.1 | 0.2 | 0.7 | 0.0 | 0.0 |
| Class D | 0.1 | -0.1 | 0.3 | 0.4 | -0.4 | -0.1 |
| Class E | | | | | | |
| All | 0.2 | 0.1 | 0.2 | 0.6 | -0.4 | -0.3 |
| Enc Time[%] | 88% | | | 85% | | |
| Dec Time[%] | 99% | | | 100% | | |
| | | | | | | |
| | Low delay | | | Low delay LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | | | | | | |
| Class B | 0.1 | 0.1 | 0.0 | 0.2 | -0.1 | -0.1 |
| Class C | 0.1 | 0.2 | 0.2 | 0.3 | 0.1 | 0.2 |
| Class D | 0.1 | -0.1 | 0.4 | 0.1 | 0.1 | 0.2 |
| Class E | 0.0 | 0.2 | 0.5 | 0.4 | -0.8 | -1.2 |
| All | 0.1 | 0.1 | 0.3 | 0.3 | -0.2 | -0.2 |
| Enc Time[%] | 86% | | | 84% | | |
| Dec Time[%] | 98% | | | 104% | | |

Results (2, NxN exists in INTRA SCU only)

| | Intra | | | Intra LoCo | | |
|-------------|---------------|-----------|-----------|--------------------|-----------|-----------|
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.3 | 0.5 | 0.7 | 1.1 | -0.3 | -0.4 |
| Class B | 0.2 | 0.3 | 0.4 | 1.1 | -0.3 | -0.3 |
| Class C | 0.2 | 0.2 | 0.3 | 0.6 | -0.1 | -0.1 |
| Class D | 0.1 | 0.1 | 0.1 | 0.4 | -0.2 | -0.1 |
| Class E | 0.3 | 0.7 | 0.7 | 1.8 | -1.1 | -0.6 |
| All | 0.2 | 0.3 | 0.4 | 0.9 | -0.4 | -0.3 |
| Enc Time[%] | 72% | | | 66% | | |
| Dec Time[%] | 98% | | | 101% | | |
| | | | | | | |
| | Random access | | | Random access LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.2 | 0.2 | 0.2 | 0.7 | -0.9 | -1.1 |
| Class B | 0.2 | 0.2 | 0.2 | 0.7 | -0.5 | -0.4 |
| Class C | 0.3 | 0.3 | 0.3 | 0.6 | 0.0 | 0.0 |
| Class D | 0.3 | 0.3 | 0.4 | 0.5 | -0.3 | 0.2 |
| Class E | | | | | | |
| All | 0.2 | 0.3 | 0.3 | 0.6 | -0.4 | -0.2 |
| Enc Time[%] | 82% | | | 77% | | |
| Dec Time[%] | 99% | | | 101% | | |
| | | | | | | |
| | Low delay | | | Low delay LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | | | | | | |
| Class B | 0.1 | 0.2 | 0.2 | 0.2 | -0.2 | -0.2 |
| Class C | 0.2 | 0.0 | 0.1 | 0.3 | -0.1 | 0.0 |
| Class D | 0.3 | -0.4 | 0.3 | 0.3 | 0.3 | 0.1 |
| Class E | 0.1 | 0.1 | 0.3 | 0.2 | -0.9 | -1.3 |
| All | 0.2 | 0.0 | 0.2 | 0.2 | -0.2 | -0.3 |
| Enc Time[%] | 79% | | | 75% | | |
| Dec Time[%] | 98% | | | 104% | | |

Remaining Issue in LoCo

- Observed bigger coding loss in LoCo.
- Identified it's related to VLC /entropy coding.
 - Working on improvement (ongoing.)

Results (3, NxN exists in SCU only*)

| | Intra | | | Intra LoCo | | |
|-------------|---------------|-----------|-----------|--------------------|-----------|-----------|
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.3 | 0.5 | 0.7 | 0.3 | 0.7 | 0.9 |
| Class B | 0.2 | 0.3 | 0.4 | 0.3 | 0.4 | 0.5 |
| Class C | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 |
| Class D | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Class E | 0.3 | 0.7 | 0.7 | 0.4 | 1.4 | 1.1 |
| All | 0.2 | 0.3 | 0.4 | 0.2 | 0.5 | 0.5 |
| Enc Time[%] | 72% | | | 69% | | |
| Dec Time[%] | 98% | | | 101% | | |
| | Random access | | | Random access LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.2 | 0.2 | 0.2 | 0.4 | 0.3 | 0.3 |
| Class B | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 |
| Class C | 0.2 | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 |
| Class D | 0.1 | -0.1 | 0.3 | 0.2 | 0.3 | 0.1 |
| Class E | | | | | | |
| All | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| Enc Time[%] | 88% | | | 87% | | |
| Dec Time[%] | 99% | | | 100% | | |
| | Low delay | | | Low delay LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | | | | | | |
| Class B | 0.1 | 0.1 | 0.0 | 0.1 | 0.3 | 0.0 |
| Class C | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.1 |
| Class D | 0.1 | -0.1 | 0.4 | 0.1 | 0.0 | 0.0 |
| Class E | 0.0 | 0.2 | 0.5 | 0.2 | 0.8 | 0.7 |
| All | 0.1 | 0.1 | 0.3 | 0.1 | 0.3 | 0.1 |
| Enc Time[%] | 86% | | | 85% | | |
| Dec Time[%] | 98% | | | 105% | | |

Results (4, NxN exists in INTRA SCU only*)

| | Intra | | | Intra LoCo | | |
|-------------|---------------|-----------|-----------|--------------------|-----------|-----------|
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.3 | 0.5 | 0.7 | 0.3 | 0.7 | 0.9 |
| Class B | 0.2 | 0.3 | 0.4 | 0.3 | 0.4 | 0.5 |
| Class C | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 |
| Class D | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Class E | 0.3 | 0.7 | 0.7 | 0.4 | 1.4 | 1.1 |
| All | 0.2 | 0.3 | 0.4 | 0.2 | 0.5 | 0.5 |
| Enc Time[%] | 72% | | | 69% | | |
| Dec Time[%] | 98% | | | 101% | | |
| | Random access | | | Random access LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.3 |
| Class B | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 |
| Class C | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| Class D | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 | 0.3 |
| Class E | | | | | | |
| All | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Enc Time[%] | 82% | | | 80% | | |
| Dec Time[%] | 99% | | | 100% | | |
| | Low delay | | | Low delay LoCo | | |
| | Y BD-rate | U BD-rate | V BD-rate | Y BD-rate | U BD-rate | V BD-rate |
| Class A | | | | | | |
| Class B | 0.1 | 0.2 | 0.2 | 0.1 | 0.3 | 0.1 |
| Class C | 0.2 | 0.0 | 0.1 | 0.2 | 0.3 | 0.2 |
| Class D | 0.3 | -0.4 | 0.3 | 0.3 | 0.4 | 0.5 |
| Class E | 0.1 | 0.1 | 0.3 | 0.1 | 1.3 | 0.9 |
| All | 0.2 | 0.0 | 0.2 | 0.2 | 0.5 | 0.4 |
| Enc Time[%] | 79% | | | 78% | | |
| Dec Time[%] | 98% | | | 105% | | |

Recommendations

- Remove NxN partition for INTER CU
 - All depth
 - All depth except SCU
- Remove NxN partition for INTRA CU
 - All depth except SCU



Thank You!

