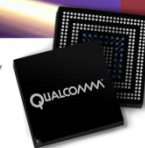




REDEFINING MOBILITY

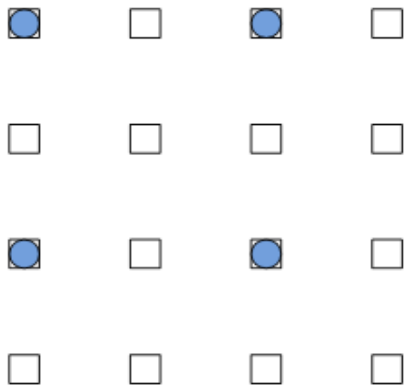


On phase alignment of up-sampling process in SHVC

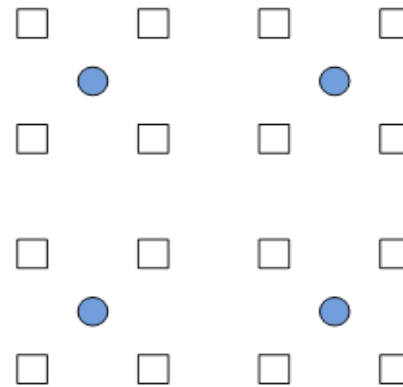
Jianle Chen, Liwei Guo, Xiang Li, Marta Karczewicz, Shufei Fan (Qualcomm)

Sample grid location of BL and EL pictures

- SHVC: zero-position aligned
- Common up-sampling process: central-position aligned
 - Scaling module in commercial products
 - Mobile, TV, Camera, Display, etal
 - Commercial software
 - Matlab, Photoshop



Zero-position aligned



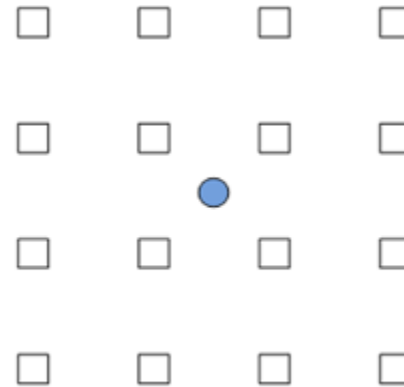
Central-position aligned

Suggestion

- SHVC shall support central-position aligned sequences as input
 - To be able to use the *widely deployed down-sampling modules* as part of a SHVC encoder
 - To use the input resource generated by the *current down-sampler used in industrial product*
 - To be able to transcode *the existing HEVC simulcast bitstream* without re-encoding the base layer



Zero-position aligned



Central-position aligned

Coding performance

- Central-aligned vs Zero-aligned input with proper up-sampling process

- Central-aligned shows average **0.3%** BD rate loss

Configuration	Y	Cb	Cr
AI 2x	0.4%	0.2%	0.1%
AI 1.5x	0.4%	0.1%	0.1%
RA 2x	0.4%	0.3%	0.2%
RA 1.5x	0.3%	0.2%	0.0%
LD-B 2x	0.4%	0.3%	0.4%
LD-B 1.5x	0.2%	-0.1%	-0.3%
AVG.	0.3%	0.2%	0.1%

- Current SHVC (zero-phase up-sampling) applied on central-aligned sequences

- Average **6.8%** BD rate loss

Configuration	Y	Cb	Cr
AI 2x	-9.4%	-10.9%	-10.9%
AI 1.5x	-8.3%	-10.2%	-10.2%
RA 2x	-6.6%	-4.1%	-3.9%
RA 1.5x	-6.0%	-5.1%	-4.6%
LD-B 2x	-4.8%	-2.7%	-2.6%
LD-B 1.5x	-5.9%	-4.9%	-4.4%
AVG.	-6.8%	-6.3%	-6.1%

Proposed solution

- Signal a flag to indicate which sample alignment schemes is used, accordingly the matched phase derivation is used in up-sampling process,

$$xRef16 = (((xP - offsetX) * ScaleFactorX + addX + (1 \ll 11)) \gg 12) - (phaseX \ll 2)$$

$$yRef16 = (((yP - offsetY) * ScaleFactorY + addY + (1 \ll 11)) \gg 12) - (phaseY \ll 2)$$

- Complexity of reference layer sample location derivation

- One add operations (0 or 4) for each pixel when calculated online
- No complexity when Look Up Table (LUT) is used
-

- Benefits

- To be able to use the *widely deployed down-sampling modules* as part of a SHVC encoder
- To use the input resource generated by the *current down-sampler used in industrial product*
- To be able to transcode *the existing HEVC simulcast bitstream* without re-encoding the base layer
- The coding gain of zero-position aligned scheme