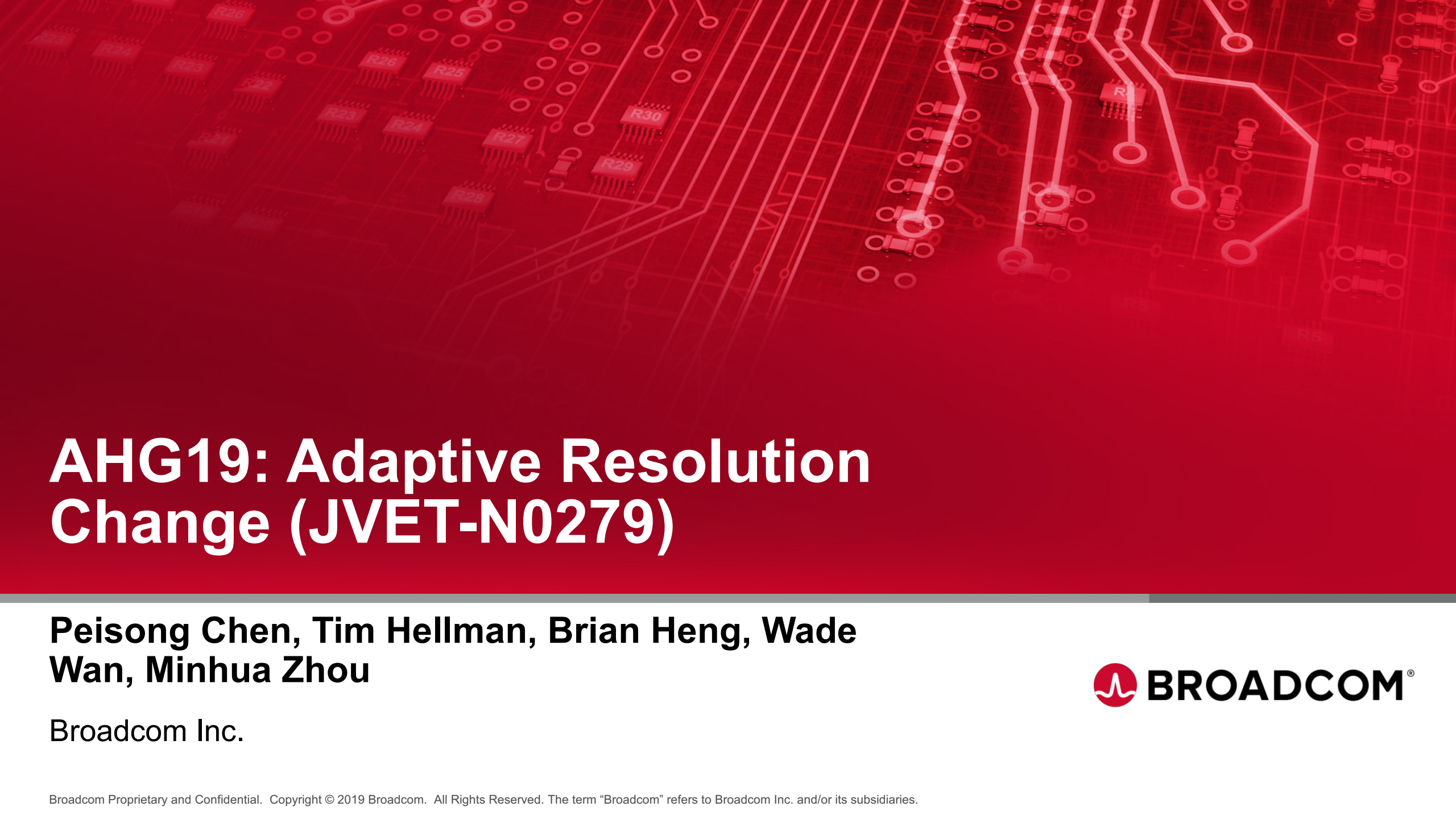




AHG19: Adaptive Resolution Change (JVET-N0279)

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Benefits of Adaptive Resolution Change

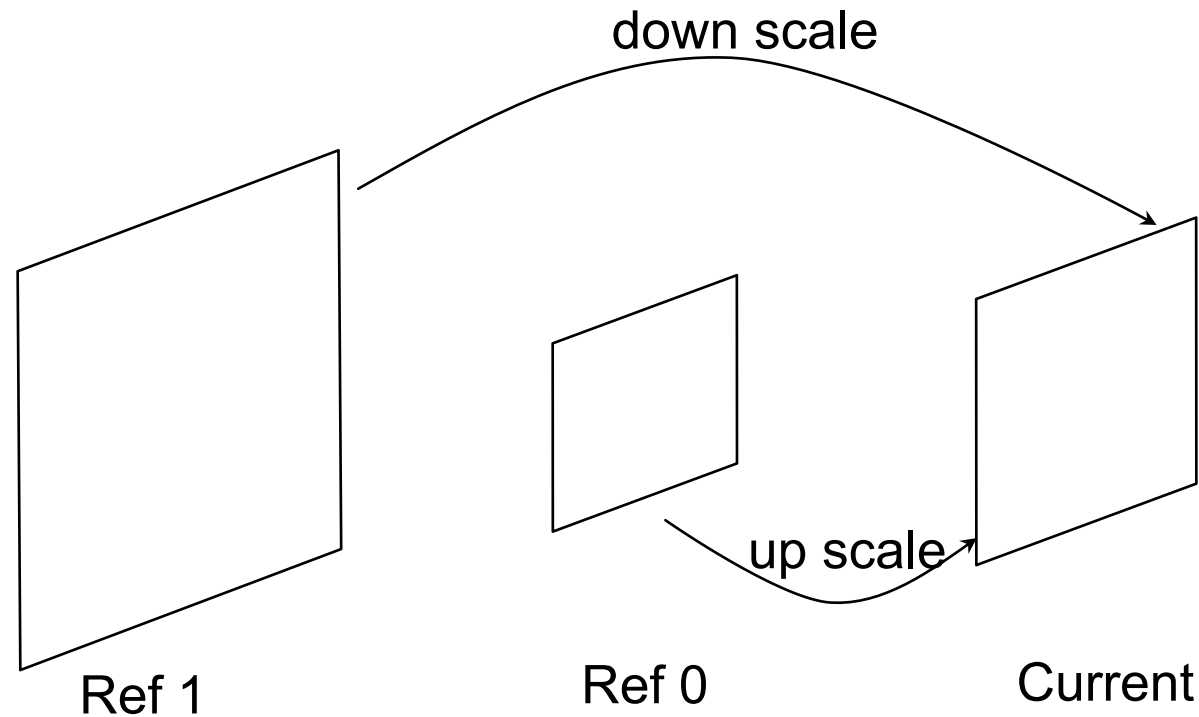
- Seamlessly adapt video resolution to user preference and bandwidth variation.
- Bit rate savings compared to inserting intra pictures.
- There is no intra picture beating effect.

Design Principle

- Reuse existing motion compensation interpolators
- Do not introduce new processing blocks
- Do not need to pre-scale reference pictures in memory.
- Transparent to other functional modules such as DPB management, motion vector predictor, deblocker, etc.

Down Scale and Up Scale

- Down scale ratio not larger than 2
- Up scale ratio not less than 1/8

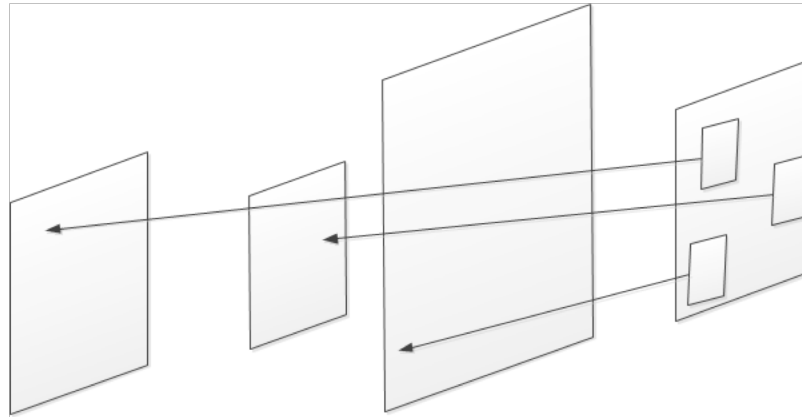


Flexible Scaling Design

- Scaling factors is determined by picture sizes.
- X/Y scaling factors are independent of each other.
- Each block can use a different scaling factor.

$$\text{hori_scale_fp} = \frac{(width_{ref} \ll 14) + (\frac{width_{cur}}{2})}{width_{cur}}$$

$$\text{vert_scale_fp} = \frac{(height_{ref} \ll 14) + (\frac{height_{cur}}{2})}{height_{cur}}$$



- When encoding motion vectors, they are normalized to the size of the current picture.
- Instead of scaling the reference pictures to the resolution of the current picture, motion vectors are scaled during motion compensation.

Reference Location Derivation

- Scaling factors is determined by the picture sizes

$$\text{hori_scale_fp} = \frac{(width_{ref} \ll 14) + (\frac{width_{cur}}{2})}{width_{cur}}$$

$$\text{vert_scale_fp} = \frac{(height_{ref} \ll 14) + (\frac{height_{cur}}{2})}{height_{cur}}$$

- Reference location mapping with motion vector scaling

$$x' = ((x \ll 4) + mvX) \cdot \text{hori_scale_fp},$$

$$y' = ((y \ll 4) + mvY) \cdot \text{vert_scale_fp},$$

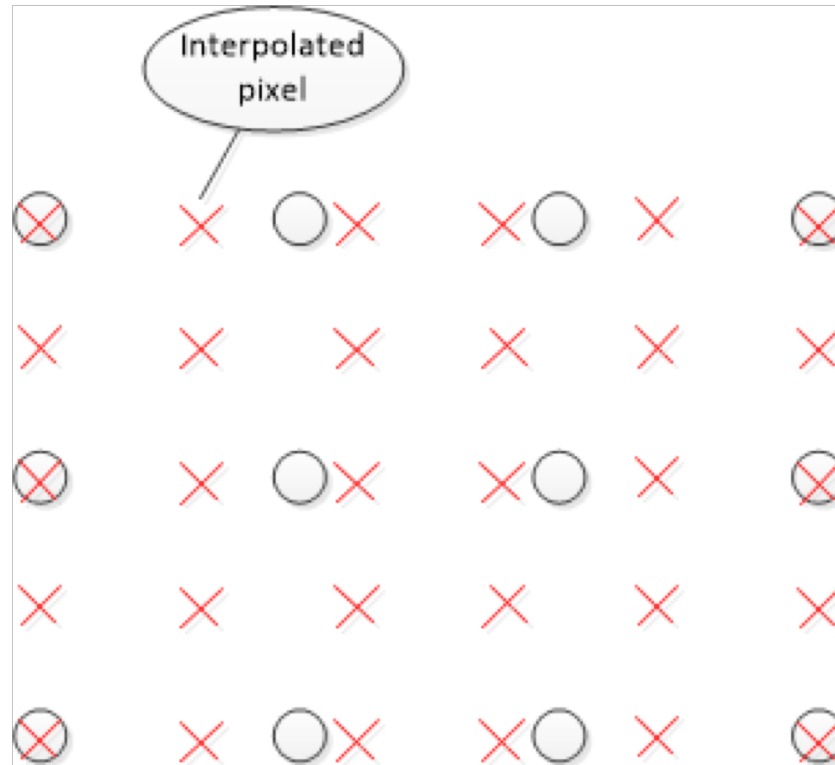
- Step Size

$$x_step = (\text{hori_scale_fp} + 8) \gg 4,$$

$$y_step = (\text{vert_scale_fp} + 8) \gg 4.$$

Example

- Horizontal scaling factor of 3:5
- Vertical scaling factor of 1:2



Interaction with Other Coding Tools

- When `tile_group_temporal_mvp_enabled_flag` is equal to 1, the current picture and its collocated picture shall have the same resolution.
- When resolution change is allowed within a sequence, decoder motion vector refinement shall be turned off.
- When resolution change is allowed within a sequence, `sps_bdof_enabled_flag` shall be equal to 0.

Software

- The current design has been implemented on top of VTM-4.0 and it has been attached to this contribution.
- It supports resolution changes within the range of $[1/8, 2]$.
- Horizontal and vertical directions with different scaling ratios are supported.

Summary

- Proposes a flexible scaling mechanism to support adaptive resolution change with the following characteristics:
 - Reference picture scaling is realized implicitly in motion compensation interpolators
 - No need to scale reference pictures in memory
 - No new processing blocks
- Recommend further study on this topic



Thank You

