

JCTVC-H0463: Comments on specifying tile support in HEVC Profiles and Levels

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- Parallel techniques (e.g. tiles) targeted towards assisting encoders
- Real-world decoders would not be able to rely on a stream to be encoded in a specific parallelizable fashion:
 - Unless operating in a closed-system
 - Profile/Level constrain streams to that specific parallelizable structure
- Unclear how tiles maps into appropriate Profile/Level definitions
- Determine whether and how tiles would fit within a particular Profile/Level definition where:
 - Every decoder conformant to that definition is required to support decoding of a stream encoded using tiles
 - Note some applications will not use tiles at all

In-loop filtering across vertical tile boundaries



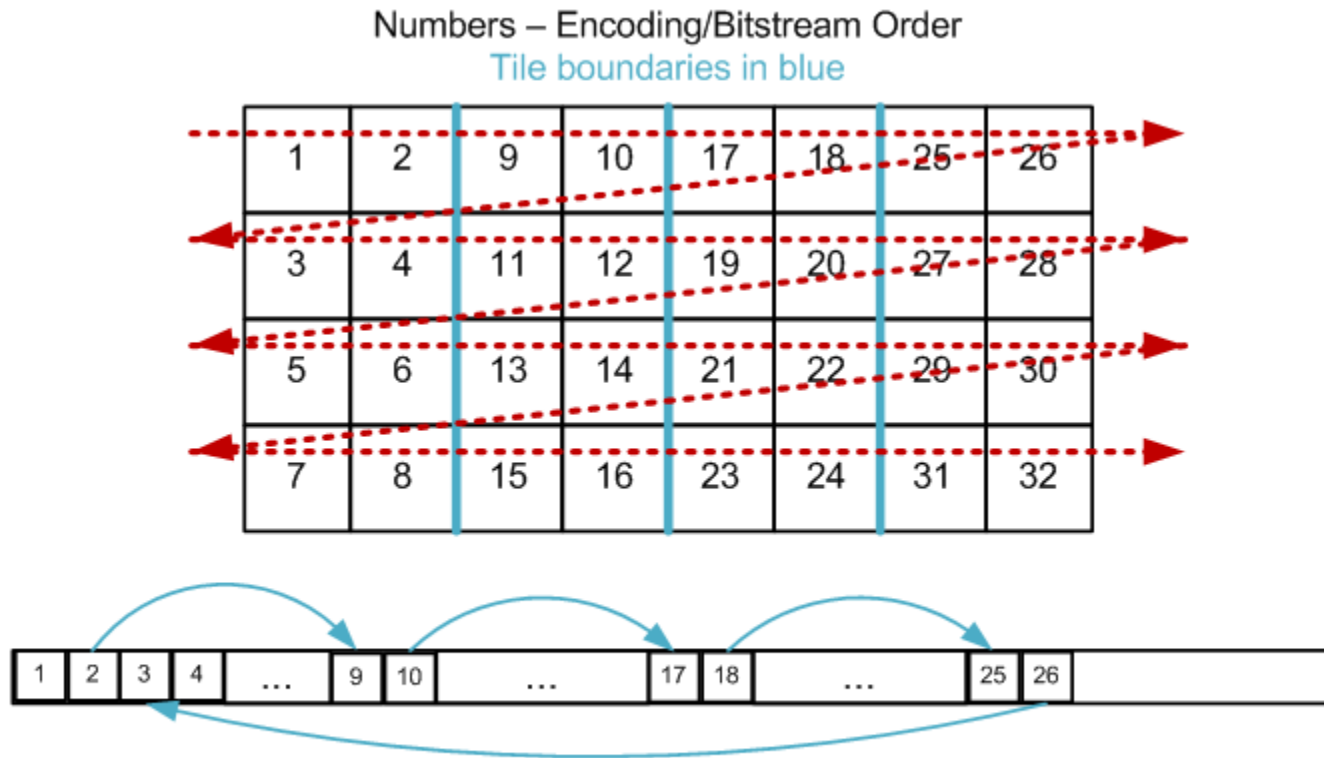
- Current definition of independent tiles:
 - Entropy and decoding are independent across tile boundaries
 - In-loop filtering does span across tile boundaries so the tiles are not “completely independent”
- Flag can disable/enable in-loop filtering across tile boundary
 - This does not change worst-case requirement for decoders
- Visual artifacts seen when all in-loop filtering (DBLK, SAO, ALF) removed
- Unclear if just deblocking across boundaries is sufficient
- Study whether deblocking is sufficient to eliminate artifacts without additional SAO and ALF processing along tile boundaries

- Unclear whether dependent tiles are really needed as independent tiles (which are simpler to support) may be able to provide sufficient functionality.
- Private discussion with proponents of original tile proposal indicate they do not anticipate use of dependent tiles in their products

➤ Prohibit dependent tiles

Constraining the maximum number of tile columns

- Issues with vertical tile boundaries already highlighted in G110
- Storage, logic and handling that must be performed at each vertical boundary to keep the decoder in the same state/context as the encoder



Blue arrows represent bitstream jumps to handle tile transitions to process one LCU row when processing a stream with tiles in LCU raster scan order

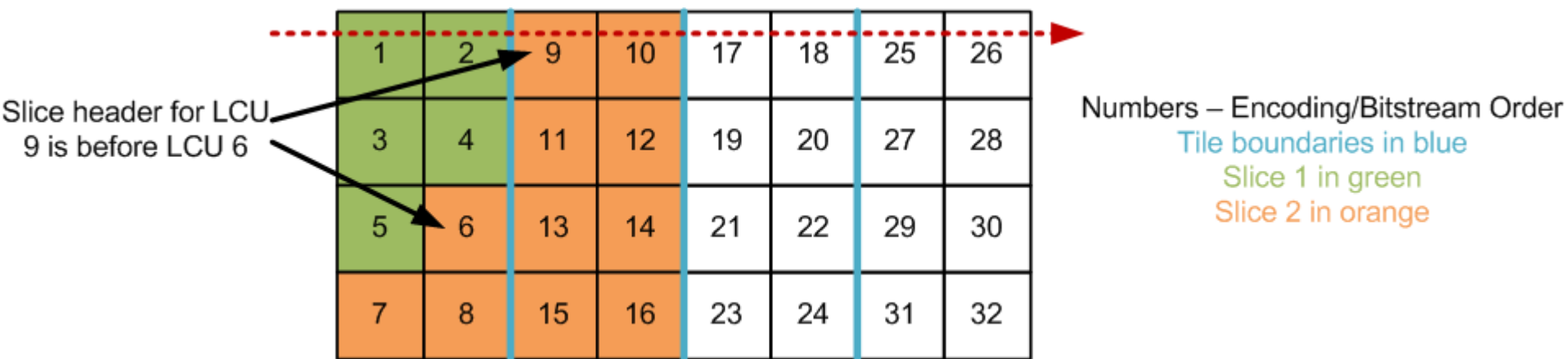
Constraining the maximum number of tile columns



- Save/reload at every vertical boundary (but does not exist for independent tiles)
 - As an aside, similar (but not as prominent) issues for wavefronts
 - Bitstream jumping does not exist if substream interleaving is not used
 - Wavefront schemes do not involve more than one save/reload per LCU row
- **Constrain the maximum number of tile columns to two**

- Tiles and slices are currently defined to be completely orthogonal to one another
- Decoder processing is typically designed to operate in a hierarchical fashion with resources allocated to blocks and then subdivided accordingly.
- The orthogonality of tiles breaks this paradigm and results in inconsistent and sporadic processing affecting efficiency.

- For slices that span tile boundaries:
 - How does one distinguish which slice should be used when crossing across tile boundaries?
 - Bitstream offset pointers? Emulation prevention considerations?



- Restrict slices such that they do not cross tile boundaries. More specifically, every tile boundary shall align with a slice boundary.

- G199 reported improvements of 0.3% compared to tiles for two threads per tile and 0.6% better than tiles for four threads per tile
 - Significant amount of complexity with supporting each of these concepts by themselves
 - Combination of these two techniques presents a very difficult problem for implementers to support all the different possible permutations.
 - Unclear whether significant additional functionality beyond what is supportable with each of the tools themselves is provided by combining them
- Prohibit the combination of tiles and wavefronts

- In-loop filtering across vertical tile boundaries
 - Study whether deblocking is sufficient to eliminate artifacts without additional SAO and ALF processing along tile boundaries
- Dependent tiles
 - Prohibit dependent tiles
- Constraining the maximum number of tile columns
 - Constrain the maximum number of tile columns to two
- Tiles and slices
 - Restrict slices such that they do not cross tile boundaries. More specifically, every tile boundary shall align with a slice boundary.
- Combining tiles and wavefronts
 - Prohibit the combination of tiles and wavefronts

Thank You

