Versatile Video Coding (VVC)

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VVC standardisation Timeline

- **Draft 1 and First Test Model (VTM-1.0)**
  - HEVC with some coding tools removed
    - Large coding gain (~15%)
- **From this clean basis**
  - Define Common Test Conditions (CTC)
  - Evaluate proposed coding tools (both efficiency and complexity aspects)
  - Agree on tools addition until sufficient performance is reached
- **Incremental process**
  - Draft 8.0 and VTM 8.0 as of March 2020
VVC block structure

- Classical block-based hybrid coding architecture
  - Intra-frame prediction
  - Inter-frame prediction
  - Residual transformation and quantization
  - Entropy coding

- Each module has been significantly improved since HEVC
**VVC vs. HEVC**

**Largest Coding Unit:**
- VVC: $128 \times 128$
- HEVC: $64 \times 64$

**Split patterns:**
- VVC: Quad, Ternary, Binary
- HEVC: Only quad

**Intra:**
- VVC: 67 modes, Advanced tools for reference selection, pixel prediction, etc.
- HEVC: 35 modes

**Inter:**
- VVC: Non-rectangular shapes, Generalized motion representation
- HEVC: Rectangular shapes, Linear motion

**Residual coding:**
- VVC: Multiple primary transforms, Secondary transform, Dependent quantization
- HEVC: Single transform, Residual Quad-Tree
Objective performance: VVC vs. HEVC

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Bitrate saving</th>
<th>Encoder complexity</th>
<th>Decoder Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3840x2160 UHD</td>
<td>-39%</td>
<td>850%</td>
<td>165%</td>
</tr>
<tr>
<td>1920x1080 HD</td>
<td>-34%</td>
<td>900%</td>
<td>160%</td>
</tr>
<tr>
<td>Lower definitions</td>
<td>-28%</td>
<td>900%</td>
<td>170%</td>
</tr>
</tbody>
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Cactus (1080) - AI

DayLightRoad (4K) - RA
Licensing: avoid HEVC confusion

Leonardo Chiariglione: “MPEG has been developing standards having the best performance as a goal, irrespective of the IPR involved. [...], but the patent pool creation mechanism seems no longer able to deliver results.”

- **Creation of the open industry Media Coding Industry Forum (MC-IF)**
  - Establishing MPEG Standards as well-accepted and widely used standards for the benefit of consumers and industry.
  - Initially focusing on VVC

- **VVC switchable tools strategy**

Leonardo Chiariglione: “We could introduce fractional options in the sense that proposers could indicate that their technologies be assigned to specifically identified profiles with an 'industry licence' [...].”