The new disruptive visually lossless light video compression, Extremely Tiny in FPGA

A technology serving the global AV industry

TICO compression is new patent-pending visually lossless compression specifically designed for the industry. This revolutionary technology is extremely tiny in FPGA fitting the smallest Xilinx Artix-7 and Spartan-6 devices, robust for real-time operation with no latency.

Up to now, image and video are sent or stored uncompressed into many displays and systems such as cameras, videos servers or recorders. TICO is a smart upgrade path to manage higher resolutions (4K, 8K …) and frame rates while assuring visual quality, keeping power and bandwidth at a reasonable budget and reducing significantly the complexity and cost of the system.

Technology benefits

> Visually Lossless quality up to 4:1.
> Robust over multiple generations.
> Fixed latency: down to microseconds Selectable from 1 to x pixel lines.
> Small complexity and ultra-compact codec: easy to implement in low-cost FPGA. Limited internal memory - no external memory required.
> Powerful, Real-time or faster than real-time in CPU.
> Compatible with different resolutions, from mobile, HD to 4K/8K UHDTV, via multiple usual transport schemes.
> Designed to be a standard for industry-wide support: TICO compression technology is available on multiple software and hardware technologies. Code, hardware IP-cores and software libraries are licensable from intoPIX.
Typical applications from HD to Ultra HD

- Digital Video Recorders.
- Video Servers, mixers, routers and switchers.
- Cameras (high-res, real-time or high speed).
- Video monitor and displays.
- Frame grabbers and video capture devices.
- Video over IP systems (ST2022, AVB,...).
- Industrial and surveillance.
- Cable extenders.
- UHD/4K over 3G-SDI.

TICO is a smart solution to

- Support Higher data stream using existing systems & infrastructures (HD/4K/8K/HFR).
- Increase the number of streams or the stream resolution.
- Reduce the internal video bandwidth (and power!).
- Cost effectively increase video buffer and storage capacity.
- Reduce the number of lanes needed to transport a stream at a display interface or at an image sensor to save power, cost or both.

Image features

- Color modes: 422 and 444, RGB, YCbCr, XYZ.
- Bit Depth: 8, 10 or 12.
- Resolutions: Any up to 8K (8192 x 8192).
- Frame Rates: Any (depending on intoPIX IP-core configuration).

Compression

- (Sub) Intra-frame.
- Real-time operation guaranteed (no overflow or underflow).
- Fixed latency - Selectable from 1 to X lines.

Quality and Bit Rate Control

- Adjustable compression rate for Lossy/Visually lossless/Math. lossless.
- CBR (constant bit rate) operation (optional capped VBR model).

FPGA

- Low cost implementation in any Xilinx FPGAs: very low FPGA logic and internal RAM usage.
- Fit in the smallest Xilinx Artix-7 and Spartan-6 FPGAs.
- Encoder and decoder have approximately the same complexity.

XILINX FPGA implementation

<table>
<thead>
<tr>
<th>IP-core Reference</th>
<th>Visually Lossless with 444 8bit (in bpp)**</th>
<th>Visually Lossless with 422 10bit (in bpp)</th>
<th>Max FPS</th>
<th>Max Resolution</th>
<th>Max Buffering</th>
<th>Quality Profile Support ***</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD</td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td>UHD/4K</td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>16 lines</td>
<td>2</td>
<td>2015</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td>MLS</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>Math. Lossless</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>Math. Lossless</td>
<td>NOW</td>
</tr>
</tbody>
</table>

* Ask for your flavor.
** bpp = bit per pixel. Example: a 444 8 bit picture equals to 24 bit per pixel (bpp). Compressed at 12bpp, it is equivalent to 2:1 compression.
*** At 4:1, Profile 2 provides better quality than Profile 1 at short viewing distance (< 60 pixels per degree).

TICO is a smart solution to

- Support Higher data stream using existing systems & infrastructures (HD/4K/8K/HFR).
- Increase the number of streams or the stream resolution.
- Reduce the internal video bandwidth (and power!).
- Cost effectively increase video buffer and storage capacity.
- Reduce the number of lanes needed to transport a stream at a display interface or at an image sensor to save power, cost or both.

Image features

- Color modes: 422 and 444, RGB, YCbCr, XYZ.
- Bit Depth: 8, 10 or 12.
- Resolutions: Any up to 8K (8192 x 8192).
- Frame Rates: Any (depending on intoPIX IP-core configuration).

Compression

- (Sub) Intra-frame.
- Real-time operation guaranteed (no overflow or underflow).
- Fixed latency - Selectable from 1 to X lines.

Quality and Bit Rate Control

- Adjustable compression rate for Lossy/Visually lossless/Math. lossless.
- CBR (constant bit rate) operation (optional capped VBR model).

FPGA

- Low cost implementation in any Xilinx FPGAs: very low FPGA logic and internal RAM usage.
- Fit in the smallest Xilinx Artix-7 and Spartan-6 FPGAs.
- Encoder and decoder have approximately the same complexity.

XILINX FPGA implementation

<table>
<thead>
<tr>
<th>IP-core Reference</th>
<th>Visually Lossless with 444 8bit (in bpp)**</th>
<th>Visually Lossless with 422 10bit (in bpp)</th>
<th>Max FPS</th>
<th>Max Resolution</th>
<th>Max Buffering</th>
<th>Quality Profile Support ***</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD</td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td>UHD/4K</td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>HD</td>
<td>16 lines</td>
<td>2</td>
<td>2015</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>max Bppp (4:1)</td>
<td>max Bppp (4:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>1</td>
<td>NOW</td>
</tr>
<tr>
<td>MLS</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>Math. Lossless</td>
<td>NOW</td>
</tr>
<tr>
<td></td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>Lossless (1.2:1 to 1.8:1)</td>
<td>60</td>
<td>4K UHD1</td>
<td>4 lines</td>
<td>Math. Lossless</td>
<td>NOW</td>
</tr>
</tbody>
</table>

* Ask for your flavor.
** bpp = bit per pixel. Example: a 444 8 bit picture equals to 24 bit per pixel (bpp). Compressed at 12bpp, it is equivalent to 2:1 compression.
*** At 4:1, Profile 2 provides better quality than Profile 1 at short viewing distance (< 60 pixels per degree).