

TICO - Light Mezzanine Compression UHD TV & HFR

TICO is the Light Mezzanine Compression dedicated to carry UHD TV and High Frame Rate signals over SDI and 10G Ethernet Network...



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Considering the necessary bandwidth for the next generation of television with higher resolution video and higher frame rates, live uncompressed transport across 10GB Ethernet network or existing SDI infrastructure is not always possible. Indeed, uncompressed 4K video at 60fps requires 12Gbps or more. The new lightweight compression "TICO" is optimal to address this challenge: a light-weight visually lossless guaranteeing compression at very low compression ratio with no impact on latency and a small hardware cost of implementation and mapping perfectly SDI links and 10GbE networks.

Motivation

Bandwidth requirements are growing fast as video resolutions, frame rates and numbers of streams to manage are constantly increasing. Uncompressed video distribution is becoming a real challenge: HD 1080i60 requires HD-SDI with 1.5Gbps bandwidth, while 3G-SDI is needed for HD 1080p60 at 3Gbps. Unfortunately, higher bitrates such as HFR HD 1080p120 and Ultra-HD 4K require more bandwidth than a single 3G-SDI link could fit. (See Table 1.)

Today, existing infrastructures limit the transport of higher quality video as 10Gbps is practically the upper limit to transport video over a single link. Furthermore, broadcast industry has just upgraded from SDI to 3G-SDI and will face heavy investments to transport uncompressed Ultra-HD 4K video. Facing this reality, the transport of compressed video through SDI mapping is relevant inside production workflows considering that it enables Ultra-HD 4K video on existing infrastructures at low cost.

Video over IP & SDI Mapping

IP based technologies are emerging as a strong market trend in the broadcast industry. The SMPTE 2022 video networking

standard defines a transport protocol for the carriage of video streams over IP networks. The adoption of IP-based technologies has the potential to bring about a number of significant advantages. However, it is important not to lose the advantages of current point-to-point, SDI-based systems in terms of familiar workflow, operational practice and interoperability.

SMPTE 2022-5/6 enables the mapping of raw SD/HD/3G-SDI video streams into an Ethernet packet. It supports the transfer of compressed video and has no limitation in terms of choice of video codec provided that the following conditions are satisfied, in particularly for broadcast purposes:

- Less than one frame latency;
- Sufficient compression ratio to fit in;
- Visually lossless picture quality.

Therefore, the TICO lightweight visually lossless guarantees compression at very low compression ratio with no impact on latency is optimal for this challenge.

Introducing TICO Lightweight Compression

intoPIX TICO is a lightweight mezzanine compression codec that has been studied to achieve

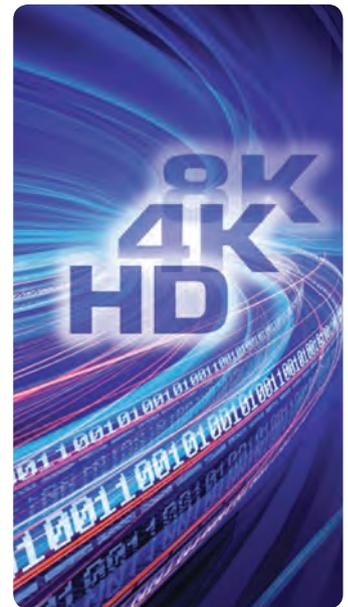
near lossless quality at very low compression ratios and for a very low hardware complexity and cost. **TICO main features are:**

- Visually lossless compression up to 4:1 ratio;
- Fixed latency from 2 to 8 pixel lines;
- Visual quality remains constant through multiple encoding/decoding passes;
- Very low hardware FPGA requirements, no external memory and real-time CPU capability;
- Support for full range of formats up to Ultra-HD 8K.

With visually lossless compressions up to 4:1, using TICO over SMPTE 2022-5/6 through SDI mapping enables higher resolutions, frame rates and number of streams while assuring visually lossless quality and very low latency. (See Table 2.)

The potential use cases of the TICO lightweight compression fall into three categories: faster pixels, more pixels and more streams.

1. HFR HD 1080p120 requires 6Gbps. A low compression ratio of 4:1, ensuring near lossless quality, could enable the transport of a HFR HD stream on a single HD-SDI link over SDI mapping, and up to six HFR HD streams on a 10GB Ethernet link.
2. Ultra-HD 4K at 60fps requires 12Gbps, or more depending on the bit depth. However, the highest speed network environment that is readily available is 10GB Ethernet. Considering the necessary bandwidth for such high



resolution video, some degree of compression is needed across the network. A low compression ratio of 2:1 or less could deliver 4K and with 4:1 we could deliver up to 3 Ultra-HD 4K streams through 3G-SDI mapping over a 10GB Ethernet link.

3. TICO Lightweight compression can also enable multiple HD streams on a single 10GB Ethernet link: up to six HD streams could fit at half bandwidth.

Conclusion

To reduce the cost of new infrastructure build out, the use of the TICO mezzanine compression system to extend the life of existing major infrastructure items, such as SDI routers and existing IP-based networks in production islands, is very attractive.

It is a smart way to assure visually lossless quality, very low latency and very low hardware complexity and cost.

More information about intoPIX TICO compression technology can be found on www.intopix.com/TICO

Table 1

HD 1080i60	HD 1080p60	HFR HD 1080p120	Ultra-HD 4K 60fps
1.5Gbps	3Gbps	6Gbps	+12Gbps
1	x2	x4	x8
HD-SDI	3G-SDI	10G Ethernet	?

Table 2

Challenges		Bitrate	Target	Compression Ratio
Faster pixels	HFR HD 1080p120	6Gbps	HD-SDI	4:1
More pixels	Ultra-HD 4K 60fps	12Gbps	3G-SDI or 10GbE	4:1
More streams	6 x HD 1080p60	18Gbps	10GbE	2:1

INVISIBLE, IMPERCEPTIBLE, It's not **MAGIC**, it's **intoPIX**.



The disruptive light-weight compression

Smart upgrade to handle more HD streams or move to Ultra HD (4K,8K) over cables and IP Network (1/10GbE) with cost and power savings. Perfect also to increase storage, bandwidth or video buffer capacity.

INVISIBLE

Low power and extremely tiny FPGA/ASIC IP-cores (no external DDR). Fast in CPU!

IMPERCEPTIBLE

- Pixel lines latency
- Visually lossless up to 4:1
- Robust over multiple generations

MORE INFO ON www.intopix.com/tico



The most advanced professional compression

Fantastic mezzanine compression for Broadcast and Cinema production workflows (ie IMF, DCP, HFR, SMPTE2022, RAW-Bayer, Storage, Playback, Video over IP...).

INVISIBLE

Compact, powerful and flexible JPEG 2000 FPGA IP-cores from HD up to 4K/8K. Also fast in GPU!

IMPERCEPTIBLE

- Sub & I-Frame latency
- Visually lossless up to 15:1
- Robust over multiple generations

MORE INFO ON www.intopix.com/jpeg2000

extraordinary

intoPIX delivers HD, 4K and 8K Video **Compression** FPGA IP-cores and software solutions, **Security** IP-cores, **Transport** IP-cores and reference designs (SMPTE2022, Ethernet-AVB) that enable to build smarter, networked and future-proof Broadcast workflows.



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