



Unleashing the power of GPU: The advantages of Luxoft's GPU-based AV1 decoder

by Oleksandr Murovanyi

Video encoding and decoding technology

Video encoding and decoding technology continues changing rapidly; the emergence of the AV1 video codec, developed by the Alliance for Open Media (AOM), has revolutionized the industry with its superior compression and quality. The cost of these improvements is in the codec complexity.

The AV1 Codec is significantly larger and more computationally intensive than previous codecs, and that's why decoding of AV1 videos at large resolution and frame rate is a real challenge on legacy platforms without a built-in AV1 decoder. Achieving the maximum possible performance for the AV1 software decoder consumes all computing resources available on the systems they run, including both CPU and GPU.

Luxoft, a DXC Company, is a primary provider of high technology R&D solutions and services to the global technology, media and telecommunications industry. We've been developing and supporting video encoding and decoding technologies for our customers through several generations of video

codecs. We design and develop custom software and solutions on streaming and broadcast video technologies for many of the top imaging and video distribution businesses globally — including gaming platforms, smart-TVs, automotive infotainment systems, advertising insertion and distribution technologies, etc. We've also been developing and maintaining HEVC, VP9 and other codec technologies for our customers globally for over a decade.

In 2019, Luxoft developed a GPU-enabled software decoder allowing video distributors to benefit from AV1's reduced bandwidth requirements without paying royalties on hundreds of millions of existing devices.

The main benefits of the Luxoft AV1 decoder are listed below:



Enhanced performance:

The Luxoft developed version of the AV1 decoder was specifically designed to take advantage of parallel processing capabilities of a device's GPUs; a GPU-enabled AV1 decoder can deliver significant performance gains without sacrificing video quality or application performance. The abundance of cores in GPUs enable simultaneous code execution on multiple pixels, resulting in dramatically faster decoding times. Real-time decoding of high-resolution AV1 videos is feasible, allowing for seamless playback across various platforms and devices and freeing up CPU resources for other applications.



Optimized efficiency:

GPUs are purpose-built for handling graphics-intensive tasks, making them an ideal choice for video processing. Moving CPU tasks to the GPUs when coupled with optimized algorithms enables efficient execution of AV1's complex decoding algorithms like motion compensation, postfiltering and other computationally demanding tasks. As a result, on systems with good GPU the new decoder on average is 30-100% faster than the original libdav1d one. The table below illustrates performance acceleration of the GPU-based decoder in comparison with the fastest CPU-based AV1 decoder dav1d version 1.2.1 (June 2023) on three generations of Microsoft Xbox game consoles. The AV1 streams have 4K resolution and are processed directly from YouTube using a simple web browser with a high-speed internet connection.

Stream	Average decoding speed, FPS						Nominal FPS/ Range
	Xbox One S		Xbox One X		Xbox Series X		
	Dav1d	Luxoft	Dav1d	Luxoft	Dav1d	Luxoft	
Above-NYC	23	32	26	58	69	123	24/SDR
PATAGONIA	27	32	30	57	66	151	30/SDR
Las Vegas	39	56	41	107	92	237	60/SDR
Yellowstone	29	50	30	107	65	244	60/HDR
Future 12K	30	70	35	117	63	389	60/HDR

Even on Xbox One S with a simple low performance GPU, the Luxoft decoder is demonstrating clear performance gains over the industry leader that relies only on CPU.

Moreover, the GPU-based decoder often consumes less power and exhibits better energy efficiency compared to traditional CPU-based decoding solutions.



Real-time applications:

The real-time capabilities of a GPU-enabled AV1 decoder open doors to a wide range of real-time applications. From video conferencing and live streaming to broadcasting and immersive virtual and augmented reality experiences, the GPU's parallel processing prowess ensures minimal latency and enables seamless, high-quality video delivery.



Future-proofing:

As technology continues to advance, GPU-enabled AV1 decoding offers future-proofing benefits. GPU architectures are evolving rapidly, delivering increased performance, improved power efficiency and new features. By embracing Luxoft's GPU-enabled decoding, organizations can leverage these advancements, ensuring their video processing capabilities remain at the forefront of industry standards.



Conclusion:

In the race to deliver the highest-quality video content with optimal compression and low CPU utilization, Luxoft's GPU-enabled AV1 decoder outshines the standard decoder provided by AOM. With its unrivaled performance, optimized efficiency, scalability, real-time capabilities, and future-proofing advantages, Luxoft's GPU Enabled AV1 decoder is powering hundreds of millions of devices globally.

About **the author**



Oleksandr Murovanyi

Group Manager

Alex is a technical lead in the Video Codecs team at Luxoft, he has more than 25 years' experience in this area. His team was involved in enabling the modern video codecs standards VP9 and AV1 on popular game consoles for leading video streaming companies. Alex is responsible for the architecture of Luxoft solutions and low-level algorithmic optimizations.

Contact our Global Head of TMT Maria Stebneva at maria.stebneva@dxc.com
For more information, please visit luxoft.com/industries/media

About Luxoft

Luxoft, a DXC Technology Company delivers digital advantage for software-defined organizations, leveraging domain knowledge and software engineering capabilities. We use our industry-specific expertise and extensive partnership network to engineer innovative products and services that generate value and shape the future of industries.

For more information, please visit luxoft.com