

Accelerated 4K Recording and Streaming Solutions for Medical Applications

Improve Resolution, Reduce Power, Expand Services, Lower Costs



Introduction

Medical services and Operating Rooms (OR) are being transformed by video. Taking a lead from the rest of the video industry, high resolution 4K/UHD cameras, instruments, displays, and visualizations are proliferating throughout, giving options for detailed sharing for telemedicine assistance, detailed presentations for training and education, and detailed recordings for patient records as well as oversight and defense. This resolution revolution enables more to be seen through endoscopes, and more to be viewed from head cameras or room monitors.

At the heart of 4K/UHD video sharing, remote streaming and content recording is the latest compression technology. New internationally agreed standards for video compression are introduced roughly every 10 years with each generation offering roughly a 50% reduction in streaming bitrate or storage requirement for similar video quality each time. The most widely used and well established codec is H.264/AVC, first introduced in 2003. The High Efficiency Video Coding (HEVC) codec was introduced in 2013, and trades off 50% better compression ratios with up to a tenfold increase in processing power required. Coupled with a four times increase in resolution, this realistically means hardware acceleration of the video compression is critical to maintaining the low power consumptions expected in medical environments where a single 6W device can replace the 600W computer required for an equivalent software encoder.

The additional compression efficiency over AVC allows either a 40 – 50% reduction in storage costs for those who implement it in recorders, or a chance to substantially increase the video quality or resolution when streaming video over a fixed bandwidth link. Meanwhile developments in coding technology continue and promise even more efficiency, but none of the most recent advances have wide scale support and only HEVC has wide scale support in hardware.

Advantech can help equipment makers to take advantage of the potential benefits of 4K/UHD HEVC based recording and streaming by providing a range of high quality hardware-based HEVC video encoders that can be used to improve storage performance and transmission efficiency whilst retaining a compact, robust form-factor. This paper describes how.

Key Application Requirements

The key focus is on providing high quality 4K/UHD live compression using hardware acceleration to maintain low power and compact form factors.

Some of the key challenges and requirements include:

- Live Video Inputs: allow video capture from a variety of sources, including 4K/UHD
- Live performance: reliably encode and/or stream 4K at a solid 60fps
- Good Compression: maximize quality for the limited available uplink bitrate using HEVC
- Quality and accuracy: support high bitrates where detail needs to be preserved and also 4:2:2 chroma subsampling to maintain best color accuracy
- Minimize Power: always limited in operating rooms to avoid fan noise
- Low Latency Streaming: as low as possible within other constraints to enable telemedicine consultations

A typical use case might have several video sources to be assembled and locally recorded with one or two streamed to either a remote classroom or to a remote consultant with a return path for assistance. For example, a room camera is used for general context, while a surgeon uses a 4K endoscope during an operation.

In several use cases, it is a key requirement to be able to support special video formats, for example for 3D recording.

How Advantech Can Help

Advantech's Video Solutions Division offers a range of low power, high performance video capture and encoding accelerators that are particularly suitable for embedded medical applications, whether located directly in the Operating Room or in the hospital equipment rooms. The acceleration products, under the VEGA family name, include modules boards and systems all capable of broadcast quality 4K/UHD live HEVC encoding at 60fps, many with 4:2:2 support for additional color clarity, and all with low power, compact size and low latency. As an OEM manufacturer, Advantech have all the skills necessary to support specialist video formats and custom image assembly.

Of particular benefit are:



VEGA-3311: Single channel 4K/UHD or 4 x 1080p 60fps 10bit 4:2:2 capable HEVC/AVC encoder accelerator plug in board with a variety of direct video capture options including 4 x 3G SDI, 1 x 12G SDI or dual 10G Ethernet supporting SMPTE ST2110 ingress. As a PCIe plug-in card, VEGA-3311 can be used to add very high quality HEVC or AVC encoding to existing equipment, or can be used along with Advantech's flexible VEGA-7010 server to create multi-channel encoders for remote production applications. The VEGA-3311 offers a high degree of programmability via either a dedicated SDK or a simple-to-integrate FFMPEG plug-in, and even can act as an accelerator for the Wowza streaming engine.



VEGA-3312: Dual channel 4K/UHD 60fps 10bit 4:2:2 capable HEVC/AVC encoder accelerator plug in board with a range of HDMI inputs and loop-through outputs. The VEGA-3312 has a special use in medical applications by allowing recording and streaming at the same time with different encoding parameters for both, and also supporting 4K/3D capture and recording.



VEGA-2002: For size-limited operations, and when 4:2:2 support is not required, Advantech can offer a very compact encoder that offers 4K/UHD 60fps 10bit live HEVC or AVC encoding and LAN/WAN streaming in a 12W package. With an easy to use, extensible web configuration interface and support for HDMI inputs as well as SDI, VEGA-2002 is a portable and flexible option for many different medical applications. It can be supplied as bare module for OEMs or integrators to fit into existing medical grade enclosures.



VEGA-6301M: Ultra-compact all-in-one encoder application platform built on the same 4K/UHD 60fps 10bit 4:2:2 HEVC capture and encoding functionality as VEGA-3311 with additionally an x86 processing subsystem for management interface, streaming protocol generation, local data formatting and recording, and system control. With a sub-100W power consumption and compact dimensions, the VEGA-6301M offers a compelling performance density with easy integration into equipment stacks.



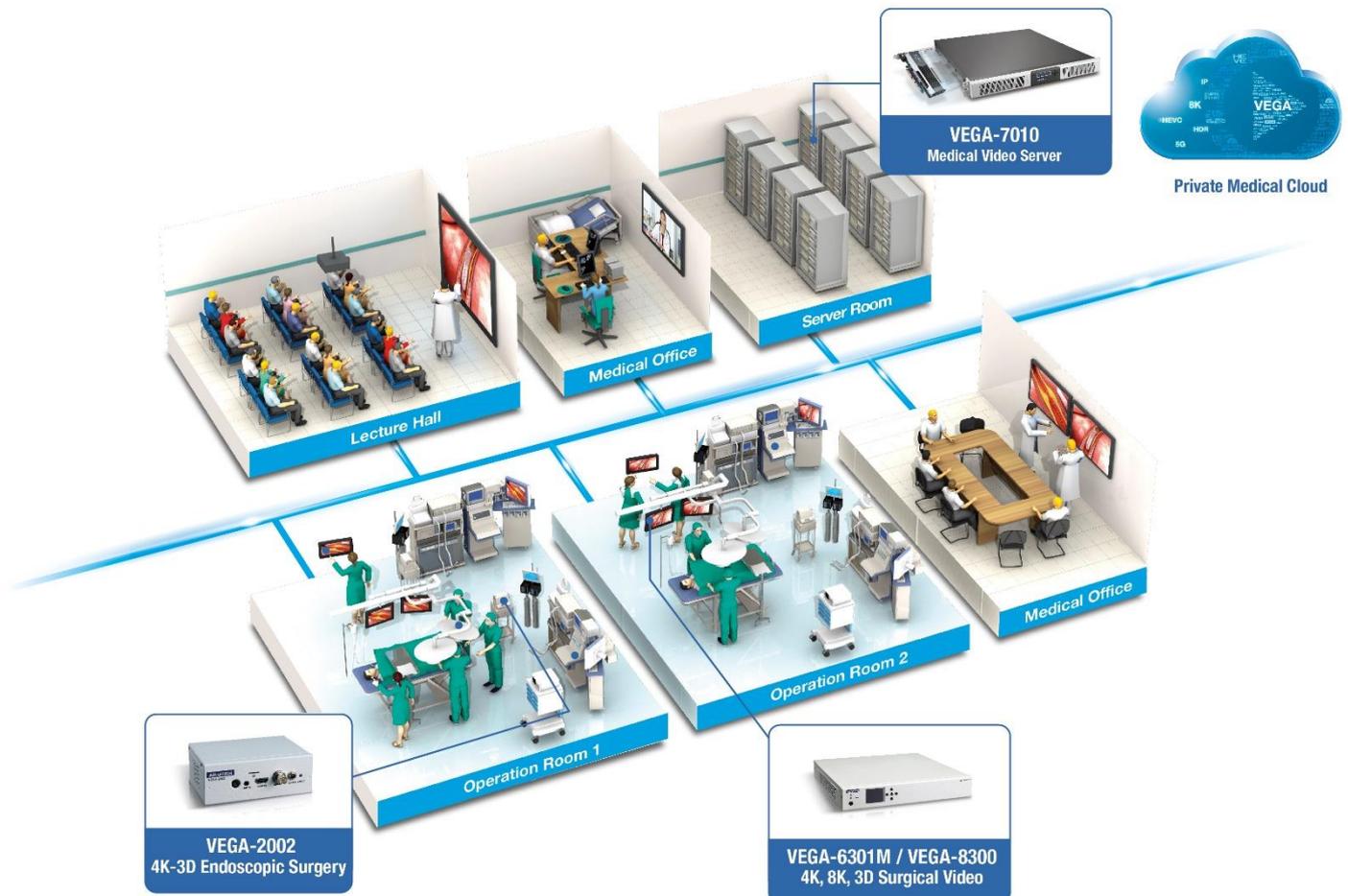
AVAS-402: Medically certified PC system supporting multiple PCI Express cards. The certification means AVAS-402 can act as the main host of an in-room recording and processing appliance, especially when equipped with VEGA-3311/12 cards for local capture and encoding.



VEGA-7010: Highly flexible video server and video appliance platform offering unparalleled flexibility in a 1U short depth profile with 4 full height PCI Express slots and a server class Xeon E3 CPU supporting Intel Quick Sync Video functionality for additional video processing. The VEGA-7010 is ideal to be fitted in hospital equipment rooms to support transcoding to create adaptive bit rate streaming ladders for transmission to remote viewers.

MediaFlow Video Manager: MediaFlow is an additional software package that system integrators can use to deploy standalone video encoding or transcoding applications using VEGA-33xx series accelerators. It runs on the VEGA-7010 host under Linux, and allows quick deployment of the accelerated encoding functions together with appropriate encapsulation and streaming outputs.

VEGA-8300 8K family: Where 4K isn't quite enough, VEGA-8300E and 8300D are new all-in-one platforms supporting live UHD2/8K 60fps 10bit 4:2:2 HEVC contribution encoding and decoding. VEGA-8300 series are ready to use by system integrators as a result of collaboration between Advantech and software partner Spin Digital who provide optimized media playout software for the decoder, and web-based system management software for the encoder. The VEGA-8300 family could be used, for instance, to set up an 8K point to point training link across a suitable LAN/WAN connection (around 100Mbit/s).



Real Life Use Case

A leading manufacturer of surgery equipment needed an updated version of an archive and record function for their new range of surgery visualization assistants. But this was no ordinary recording system. The machine was required to record and archive everything the surgeon saw through their 3D interface during operation, and at the same time record a wider patient view plus information about the precise control actions initiated. It was important to keep high quality recordings, but on the other hand reduce the ongoing storage impact for hospitals who needed to store this information for many years.

The Advantech [VEGA-6301M](#) was the answer, together with special customization from Advantech's video experts. Three separate SDI inputs captured video from stereo 3D surgeon view and patient view respectively, and these were scaled and assembled together into a single 4K composite image using FPGA-based processing and then compressed for recording alongside time-stamped metadata representing the surgeon control movements. The video was recorded locally onto high capacity SSD with an ability to bulk offload to hospital storage via a 10Gb Ethernet port.

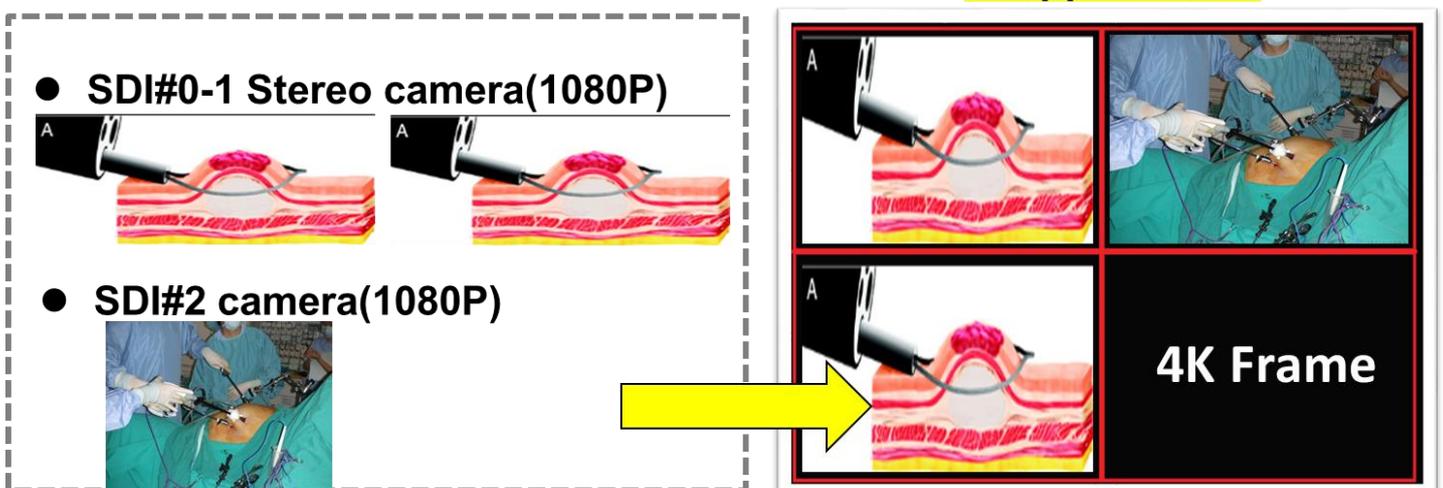
Medical 3D Video Processing & Archival on VEGA-6301M



- **Combine stereo and single video to one frame, then compress for stream & archive**

Video Input

Wrapper Frame



Advantech VEGA Benefits:

- **Acquisition support:** custom format video from several cameras is directly acquired by the VEGA-6301M via built-in video inputs, and pre-processed according to application need.
- **High quality video encoding:** the VEGA-6301M supports professional grade 4Kp60 10-bit 4:2:2 HEVC encoding. The hardware-based solution is ideal for guaranteed performance at high bit rates yet maintaining small form factor and low power consumption.
- **Application ready platform:** The capability of the encoding is well supported by the rest of the surrounding system, including x86 processor, network connections and SSD storage.
- **Integrated Video Solution Provider:** Advantech offered a one-stop shop video solution, plus with our dedicated R&D support and global experience, we delivered a state-of-the-art product with the functions required.

Products Used in this Project:

- [VEGA-6301M](#)
- Design Services

Summary

Advantech's video solutions, including UHD PCIe encoding cards, offer medical OEMs a way to create cost-effective high quality 4K recording and streaming solution without compromising operational efficiency, floor space, power consumption and total cost of ownership (TCO). It's an ideal solution for all medical recording or live streaming applications.

Advantech Contact Information

Hotline Europe: 00-800-248-080 | Hotline USA: 1-800-866-6008

Email: video.solutions@advantech.com

Regional phone numbers can be found on our website at

<http://www.advantech.com/contact/>

<https://www.advantech.com/solutions/video-solution>