The advantages of EDIUS NX/SP system for HDV realtime editing

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Canopus VP Department

The advantage of realtime editing is that it enables verification of the final output immediately by cut-and-try editing. Verification of final output is done to check that video and audio are completely synchronized in full frame, full resolution in the native display environment (usually HDV). It is meaningless to check final output that is half resolution or without synchronized video and audio. Moreover, since HD editing is new, there are various TV systems for display, such as liquid crystal display, plasma panel, CRT, rear projection, which all have different features. It is necessary to check the output with color correction and titles in the same environment as the final output. The camera vendor designs the camera output to show the best image on any HDTV format. The quality standard for HDV editing is the component video output from an HDV camera directly shown on HDTV. In other words, monitoring video and audio should be exactly the same as what will be shown on HDTV when replayed by the camera directly. Quality verification is the primary reason to have realtime output monitoring. It is meaningless for professional users to have a realtime editing system with a monitoring system that reduces frame rate and resolution. Furthermore, the PC monitor cannot be used to check the final HDTV output because PC monitors have different characterisics from HDTV. Therefore it is impossible to increase editing efficiency and create sophisticated artwork without being able to check the final output during the editing process.

For DV editing, it is possible to compress video files on timeline in realtime and output the compressed data at all times because the compression method is based on single frames. DV cameras can decode output to analog video and audio when they only receive 1 frame of data. However, since the HDV format has a Long GOP structure in the MPEG format, the camera cannot decode the video without transferring at least 1 GOP (about 0.5 seconds) of data to the HDV camera to show a new frame. Generally speaking, it takes a few seconds to start video playback after MPEG data transfer to the camera begins. Also, it is impossible to accurately monitor video and audio by using the camera as a realtime decoder since it takes time to process the MPEG output in the CPU via software. This is because it takes 0.5 seconds of data to decode the source frame's contents. Even if the data saved on the PC is already in MPEG format, the output response during editing would be miserable even though output on the PC display would be fine. The slowness of scrubbing on timeline, the limited number of tracks processed in realtime, and limited transitions provide an unacceptable level of performance for users who have already experienced realtime DV editing. It is unrealistic to edit efficiently in the native MPEG format even with the highest PC specifications.

EDIUS NX for HDV and EDIUS SP for HDV provide the solution for the aforementioned problems

by using total integration of codecs, hardware, and software. They also realize Canopus HQ format realtime editing in addition to native MPEG format editing. The Canopus HQ format can decode each frame of video as well as the DV format does because it uses single-frame compression.

The advantage of compression

In an uncompressed HD editing system, more than half of the total system cost is the cost of storage. This is because uncompressed HD data is very large and it is difficult to maintain adequate data transfer speed. Also, it is necessary to compress the data in order to provide a networked editing system in future. In a networked environment it is very hard to provide 3 streams of uncompressed HD to 5 editing stations in realtime even with the highest fiber channel server system. Furthermore, compression increases realtime performance because it reduces the amount of data transfer in the PC. However, the degradation of resolution due to compression and increased CPU load for decompression are trade-offs.

The Canopus HQ codec

The Canopus HQ codec was created to provide the benefits of video compression without losing any of the HDV format's original resolution. The HQ codec maintains HDV resolution in a reasonable size by using dynamic variable bit rate with automatically adjusts to accurately represent both simple and detailed scenes. Also, to reduce CPU load for compression and storage, the Canopus HQ codec uses an original technology approach to processing. The HQ codec uses an upsampled data structure to provide better resolution while most competing HDV editing systems reduce the resolution on compression to resemble realtime performance. That is why Canopus users don't need to worry about degradation of resolution during realtime editing.

Cooperation between the Canopus HQ codec and hardware

The Canopus HQ codec compresses and stores HDV data into 1440 x 1080i YUV 4:2:2 format. It preserves the original resolution and optimizes CPU processing by using the same 1440 horizontal resolution as HDV data. When the 1440 resolution data is transferred to the EDIUS hardware, the EDIUS hardware upsamples it to 1920 horizontal HD resolution using hardware on the board. This upsampling (horizontal interpolation) process greatly affects the quality of the final output. For example, viewing the SONY HDV sample video with EDIUS hardware, small slow-moving dots and lines move clearly on the display. When the interpolation processing method is inferior, small moving objects appear to flash or change sizes. The EDIUS hardware performs a FIR filter of a high order in realtime on it high speed processing hardware. This level of filtering quality cannot be performed in software using with current CPU performance. Thus, it is ideal to leave this output processing to dedicated hardware and free the CPU to process realtime editing.

Synchronization of video and audio

The EDIUS hardware uses the same data packet transfer architecture as its predecessor, the DVStorm. In this method, the board combines video data, audio data, deck control commands, and other frame information into one data packet in main memory then transfers that data to a FIFO buffer automatically by DMA. That is why EDIUS hardware can provide reliable synchronized video, audio and deck control commands without any additional CPU load.

Display on the PC monitor

In our competitors' editing method, the CPU must transfer the monitored video to the PC graphics board through software, which requires CPU processing. Therefore, it cannot provide synchronized video and audio because of the increased CPU load. With EDIUS hardware, the DMA controller on the board scales the decompressed video data to the correct size then it transfers the video data directly to memory on the graphics board. This method does not need to any additional CPU processing and leaves more CPU processing power for realtime performance with the EDIUS hardware.

Video Encoder

The video encoder circuit on the EDIUS hardware is designed to produce a broadcast-level component video and reference signals. It has precise output level and YUV color balance with high quality S/N ratio on the analog output due to its 148MHz 12bit oversampling video DAC – twice that of HD video. This output design compares favorably with the HDV camera's component output and its audio circuit design also provides a high quality SN ratio and low rate of distortion.

This integration of hardware, software, codec realizes unparalleled realtime performance and resolution on EDIUS hardware. When editing with EDIUS hardware, the analog component video and audio signal always outputs from dedicated output circuitry to ensure HD master quality. During realtime playback, it guarantees full realtime performance and true HD resolution frame output. It never scales down frame rate or reduces resolution. It also guarantees that video and audio are always completely synchronized. On the video output, it guarantees that the signal level, the SN ratio, the proper level and positioning, and prevents degradation of resolution by providing the same level of horizontal interpolation as an HD broadcast signal. When monitoring this signal during editing, the EDIUS hardware ensure a signal of the same quality as what will be viewed from the camera after exporting to tape.

These design decisions make EDIUS hardware achieve realtime HDV editing.