The Advantage and Necessity of EDIUS NX/SP Board for HDV Editing

January 13, 2005

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One advantage of having exclusive hardware when editing video is that it can increase realtime editing features and enables you to check the video and audio in realtime while editing in the exact same environment as the final output. This report focuses on the necessity of monitor output to check the editing video and audio result.

It is essential in a professional editing environment that the final output result of video and audio is always displayed/checked on the monitor while editors are editing in HDV. HD video has various display formats; i.e LCD, plasma, CRT, or rear projection. Each of these types have significant differences in display quality and characteristics, therefore the final master clip cannot be completed unless the editing result is correctly confirmed while editing. Many video camera manufacturers adjust their camera to output the best quality video when monitored on any HDTV. Video display position, the size, title visibility, and colors on HDTV differ greatly from the current SD televisions. Because of these differences, editors often encounter problems during content creation for HDTV display. While editors need to acquire new tips for editing, the important criteria they rely upon will be the image displayed on the HDTV, which is the output from the camera's component output. In other words, the edited video and audio on the monitor should be exactly the same as the video clip which the camera plays back directly from the tape to the HDTV. This is where monitoring the output makes an important difference. Even if it can play back in realtime, a system that drops frames or lowers the video quality to display on a PC monitor cannot be qualified as a professional's realtime editing system. Specifically, the PC monitor has different display characteristics from HDTV, which means it is impossible to visually check color correction and gamma adjustment. DV editing compresses images by frames, which enables the DV compression of the video on the timeline in realtime with constant output to a DV camera. The DV camera can provide analog output of the image by receiving only a single frame of data. However, in the case of HDV, because of its long GOP structure, a decoder cannot decode the video image unless at least 1 GOP of data (approx. 0.5 sec) is sent to the HDV camera, even to display a single frame. Generally, it takes a few seconds after starting to send the MPEG stream before video playback begins. Also, MPEG compression takes a huge amount of time when the data is processed in software by the CPU, so it is unrealistic to monitor the video and audio editing result by using a camera as a decoder, because checking a single frame will take more than 5 seconds.

Three methods have been presented for video and audio monitoring for HDV editing:

1. Use a dedicated HD/HDV editing board to output HD master quality video and audio

2. Connect the VGA output or component analog signal of the graphics board to HDTV, and connect the sound output of PC to the HDTV.
3. Display the video on the PC monitor, and output audio from the PC's audio circuit.

The only products shipping that utilize method 1 currently are EDIUS SP/NX and EDIUS HD/SD (hereinafter referred to as "EDIUS Hardware"). The EDIUS Hardware outputs the analog component video and audio in HD master quality from a dedicated output circuit. It guarantees realtime, full frame output for realtime playback, and does not drop frames or lower the quality. Audio and video synchronization is complete and guaranteed. The same quality as a broadcast quality HD signal is maintained in the signal level, SN ratio, synchronizing signal level and position, and quality deterioration by horizontal interpolation is prevented. The monitored signal during editing will be of equivalent quality to the content that is written back to the tape and played back from the original playback system.

HDV 1080i (Sony HDV camera format) records in MPEG format with 1440x1080 resolution video to the tape. To accurate edit the video shot, it is necessary to edit in 1440x1080 resolution and monitor in 1920x1080, horizontally stretched through the component output since HDTV displays are designed to receive a 1920x1080i signal. HDTV defines its input signal as an analog signal with its horizontal and vertical display position and size in its resolution. To monitor a high-quality video, a multitap digital filter is required for horizontal interpolation processing. Because high-quality monitoring requires a high order digital filter, performing the same quality processing in the CPU and graphic chip is practically impossible. EDIUS Hardware processes it in realtime on the board, matching its display timing with the HDTV requirements. This enables the EDIUS Hardware to produce a video signal that completely meets HD master quality. Furthermore, the high quality audio circuit on the EDIUS Hardware precisely synchronizes the audio with video to provide superior quality audio.

In method 2, one of the RGB outputs of a graphic card with 2 outputs is connected to an HDTV's RGB input. The problems with this method are:

A. The original component output is in YUV format, which has different dynamic range compared to RGB, with different color representation range. Also many HDTV displays have different gamma characteristics for the YUV input, so input from RGB results in a difference in video quality.
B. In many HDTV displays, RGB and YUV signals have different relationships between the synchronization signal and the video monitoring area. Even if an editor has confirmed the safe area on the HDTV display, when the editing result is written back to the tape and monitored from camera's component output, it may be displayed in a shifted position.
C. This method does not guarantee synchronization between the audio output from the audio

circuit and the video played back from the graphic circuit because there is no way to check the audio and video together from the editing software.

D. The graphics board's RGB output does not have accurate calibration and is not intended for professional video output. In the professional editing environment, even a 10% difference in analog video signal level cannot be tolerated. It is impossible to perform accurate color correction by relying on the RGB monitor output from the graphics board.
E. This method cannot guarantee that all video frames are fully played back. Many of the systems that incorporate this method will drop frames and/or lower video quality but play back audio normally to give the appearance of realtime playback. Video may jump to next frame, giving the impression that the clip was interrupted and making verification of the edited master clip impossible.
F. 1080i is an interlaced video signal, however the PC graphics card outputs progressive frames. This causes video clips with dynamic motion to be displayed differently on an RGB monitor from the original HDTV video.

   Some graphics boards may have a dedicated component output connector; however most of them still have the above issues.

Method 3 involves checking video quality on a PC monitor. In addition to the issues with method 2, method 3 has another critical issue that makes monitoring significantly different from the original HDTV video. In editing software, a video clip is displayed in the view window on the PC monitor, which is smaller than 1920x 1080, and cannot confirm the final status of how small title text and other details will appear on an HDTV. Usually, the PC will display the entire video frame including the safe area and it is difficult to confirm the display area of a true HDTV display. Editors cannot rely on such a monitoring environment to finish their final edit, which forces them to write back to tape and play back with the camera for confirmation. Writing back to the tape requires re-encoding to MPEG, consuming a significant amount of time, which cannot be practical for professional use.

After understanding the available HDV editing methods, it is easy to see that the exact quality of component video and audio signal output from an HDV camera or deck should always be output and monitored on an HDTV in full frame and full resolution, and doing so requires a dedicated hardware solution like our EDIUS Hardware.