DIGITAL TV: CONVERTING TO DIGITAL TELEVISION

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Digital TV: Converting To Digital Television

Considering the legacy of NTSC video material in existence, converting those vast libraries and signals from standard definition television (SDTV) to high definition television (HDTV) is generating considerable attention. Millions of dollars are invested into video facilities operating in NTSC analog and/or digital format not to mention the large installed base of consumer television sets and commercial projection systems. One can look at DTV and HDTV from various technical points of view. From each point of view the solution to the conversion problem seems straightforward. But, stand back a moment to view the "big picture" and it takes on a convoluted course analogous to the Los Angeles freeway system.

Consumers and content providers alike will not have the same type or quality of video equipment in use at any given time. So, how are DTV signals to be provided to the masses when there aren't consistent reproduction systems? How will you select material based on the type of display you own? Can you modify the incoming program material to optimize the quality on your display system? Answers to these questions will take many forms.

Broadcaster's Point Of View

Video producers that recently invested in the conversion from analog to D1-based digital production systems are not interested in obsoleting their new equipment in favor of DTV gear. And, they don't have to. The transition will take time and the ingress of DTV broadcast equipment will coexist with high quality NTSC originating systems. The 640 x 480 resolution is one of the supported DTV rates which will nicely support converted NTSC. Conversion equipment will perform the conversion similar to the line doubler function although more complex.

Broadcasters are looking for high performance conversion systems that will shortcut the time to market for DTV. Probably the two key providers of this type of converter are Faroudja Laboratories and Snell & Wilcox. Both companies have identified this niche market as one in which they may offer cost effective solutions to the broadcast community through their respective knowledge in scan conversion. Much of the scan conversion technology marketed in the audio-visual area is applicable as subsystems within the DTV and HDTV conversion task. However, the process is much more complex than adding a line doubler. For example, Snell & Wilcox offers a new up-converter, the HD5100. Internal processing is 10-bit resolution with integral time base correction and filtering (interpolation) of both vertical and horizontal information. The interpolation process has its roots in traditional upconversion techniques used in line doublers and quadruplers, but incorporates at least two stages of interpolation via multitapped digital filters in both the luminance channel and chrominance channel. In addition to providing auxiliary video input keying and other control functions, the converted video is delivered at the 74.25MHz clock rate for HDTV. Both analog and digital HD outputs are supplied. The analog is useful for local monitoring while the digital HD is used as the data stream for the MPEG-2 encoder, and on through the balance of the coding process.

From the broadcasting point of view, NTSC source material may be reformatted within the digital domain to the optimum ATSC format for economic transmission with respect to other programming, data broadcasting, or special HDTV events. There will be a variety of conversion solutions made available to broadcasters by specialized scan conversion manufacturers.

Interestingly, the conversion process will likely be dependent on factors having nothing to do with picture quality. The number of simultaneous channels and income optimization will likely be the largest factors in this decision. In fact, for all existing or newly created NTSC material there would be little advantage to converting to HDTV unless the supplier returns to the original film source material.

With coming set top box converter technology, the end user could convert to essentially any format desired. In a way, this flexibility might be likened to the use of a line doubler or line quadrupler in audio-visual applications for the purpose of "improved resolution" in specific applications. Once the image is received as a digital file, the conversion choices at the destination are several.

Make It What You Want It To Be

The role of DTV in your own home, or in the facility of some customer, will take on a different perspective depending on the type of display equipment available. Front-end converters capable of digitally transcoding any of the formats received will be popular. This is important not only because the signal is DTV, but because it must be reasonably matched to the

display device. Therefore, the converter or "set top box" is much more than just a simple line rate conversion tool.

HDTV's 16:9 aspect ratio will not play appropriately on a standard 4:3 aspect ratio display unless image scaling is performed. For users with data projectors in place, the projector may be programmed for any number of line rates and aspect ratios. The remaining consideration would be the proper sizing of the screen to display the right aspect ratio. With respect to projection, it is important to remember that each projector type has an inherent "sweet spot" or optimum resolution at which it should be operated.

Your Goal: Optimize For The Display

Regardless of the user or situation, decoding preferences for DTV signals will, at some point, be based on the method needed to obtain the best image quality on the display at hand. In reality, doesn't that make sense?

Imagine having a set top box or stand-alone converter capable of proper decoding of all 18 digital formats. Now, suppose you could "tune" this box to provide the optimum video quality for your particular display. Sounds something like our current experience with computer monitors and the plug-and-play approach, doesn't it? Well, close, except the job of computers and operating systems is to identify the maximum resolution capability of your monitor against the best capability of your graphics system.

That's not a bad approach, but it isn't necessarily operating the monitor at its optimum image quality capability. Oh, don't expect the display manufacturer to tell you that your 1280 x 1024 monitor really only has appropriate shadow mask resolution and video bandwidth to display 1024 x 768. That's not good marketing. You're going to have to determine that for yourself.

Like plug-and-play, manufacturers of television receivers and monitors capable of displaying 16:9 images will have a variety of internal image processing options that, presumably, will provide the user with simple, transparent operation. Some manufacturers may limit the number of operating line rates so as to optimize the display's performance based on the technical merits of its CRT, LCD, or whatever imager is used. This approach means that image scaling will be a necessity.

Wrapping It Up With The Right Display

The business of digital signal conversion is big. As the medium we use becomes digital, manipulation will be just a converter-of-our-choice away from realizing the best image available from the data. More important than understanding the technical complexities of digital conversion and DTV, our point of view toward television must change if we are to realize the most from it.

The decision maker in digital conversion, or processing in general, is making a better image. This goal is realized when the viewer is aware of the strengths and weaknesses of the overall imagery system being used. Matching signals, converters, and displays to obtain the optimum imagery performance is the essence of the process. Of highest importance is the display device, as this is the weakest link in the system. Understanding how to get the most of any display is the key to success in maneuvering through the digital video format jungle.