Telairity Dives Deep into 4K Technology – Part 12

Looking at the limited headroom left to new compression technologies after MPEG-4, it does not appear that better compression will be of great help in lowering the 10X flood of bits created by new 4K UHD resolutions, let alone the 100X flood needed for 8K UHD. Over time, MPEG-5 may reach its goal of eliminating 1 out of every 2 bits left by MPEG-4 compression. However, it seems a safe bet that no amount of additional compression will ever halve the MPEG-5 bitrate again.

Fortunately, there is another way to reduce bandwidth requirements – just cut back on the number of bits generated by new resolution standards. The only truly fixed part of the 4K UHD standard is its quadrupled pixel count. By definition, 4K doubles the W x H dimensions of 2K HD to an array of 3840 x 2160 pixels. So much is inescapable.

In addition, there is substantial pressure to adopt the new HDR10 Media Profile, requiring an upgrade from 24 to 30-bit pixels – a further 25% increase in the data required. Multiplying out both changes yields a total increase of 4 x 1.25 = 5X the number of HD bits. The other half of the 10X increase for "full" 4K UHD comes from the requirement to run at double the 30 fps rate of HD. But, since movies have survived for over a century at 24 fps (more or less) without (much) complaint, this part of the new 4K standard can probably be ignored, assuming both the higher pixel count and heightened color range are implemented.

Let us consider, then, a reduced 4K UHD standard, beamed or streamed at 30 fps, requiring a mere 5X increase over 2K HD bit rates. This version of 4K raises the HD raw data rate of 1.5 Gbps to 5 x 1.5 = 7.5 Gbps. Running this 4K figure through the compression ratios set out in the previous part of this series means MPEG-2 (100:1) reduces it to 75 Mbps, MPEG-4 (3:1) to 25 Mbps, and MPEG-5 (2:1 to 3:2) to somewhere in the 12.5 to 16.7 Mbps range.

Looking at these figures, let's use 18 Mbps as a safe target data rate for 4K UHD. 4K might be done in less, but a reasonably high quality version (excluding the doubled frame rate) should be doable within this envelope. As for 8K UHD, let's reduce its required bit rate, to the maximum extent possible, by implementing only its 4X increase in pixel count. This yields a quality MPEG-5 data rate of 4 x 18 = 72 Mbps. And, by applying a theoretical MPEG-6 level of compression, able to use 2023 levels of compute power to generate (say) a further compression of 4:3, this figure might come down to the neighborhood of 55 Mbps.

Thus, by shaving off parts of the new UHD standards, then applying maximum compression pressure to what remains, we have lowered the river of UHD bits as far as seems feasible. The rest of the gain needed to support UHD will have to come from raising the bridge.

What are prospects for getting, first, 18 Mbps, then 55 Mbps, of bandwidth to a UHD TV? And by when? We will consider this question in two parts: wirelessly and wired. For wireless transmission, we will look at over-the-air broadcasting. For wired transmission, we will look at cabled Internet delivery. Starting in the next part of this series.

Telairity has made a name for itself as the industry's leading video processing solutions provider. Please write in to us at **sales@telairity.com** to learn more about our products and to collaborate with our team.