Opinion Paper

MPEG-4 AVC comes of age in newsgathering

Following NAB last year I remember reading a few articles highlighting a general lack of innovation in satellite newsgathering. The mood before this NAB seems to be slightly different, especially with respect to the impact of MPEG-4 AVC in contribution applications.

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The move from analog SNG to MPEG-2 delivered bandwidth savings, enabling transmission costs to drop. So successful was the technology that a few years ago virtually all contribution was done using MPEG-2 encoding and DVB-S modulation over satellite. The same equipment could operate through a very ample range of bit-rates, could switch between 4:2:0 and 4:2:2 subsampling modes, and even between SD and HD. One could go out and capture news in the morning and high-quality premium sport events in the evening, on the same day, with the same truck.

New technology advances are now promising more efficient methods to encode and deliver signals. DVB-S2 improved error correction and has already shown that up to 30% of satellite bandwidth can be saved compared to DVB-S transmission. Its implementation is simply ideal in green field applications and small to medium receiver networks. Likewise, the spread of fiber networks and the flexibility of transmission over IP mean these are quickly becoming an obvious alternative to satellite, especially for equipment supporting the resilient SMPTE 2022 (ProMPEG CoP #3 FEC). On the other hand, while MPEG-4 AVC already proved to be able to deliver around 50% bit-rate saving in DTH (direct-to-home) applications compared to MPEG-2, it hasn't established itself within contribution yet. Why? And, is it ever going to displace the dominance of MPEG-2 in this area?

The resistance to wide adoption of MPEG-4 AVC for contribution has been partly blamed on a lack of equipment, with the majority so far not being able to cover the range of applications or the standard of integration of existing MPEG-2 devices, while providing fundamentally unusable latencies.

The subject of latency, in particular, is not an easy one. Both MPEG-2 and MPEG-4 AVC were developed principally for non-latency critical applications (such as DTH). This is evident, for example, in the concept of B frames (the bi-directionally predicted pictures) which are an extremely powerful tool for the exploitation of temporal redundancy, both in the past and in the future. However, holding references of past and future images requires re-ordering the sequence in which the incoming frames are encoded and this adds a latency that is intrinsic within the algorithm and cannot be avoided. Its value is tightly correlated to the input video frame rate and is independent of the processing power available. MPEG-4 AVC further extended this concept and certain B frames can themselves be used as references for other B frames. The improved efficiency, however, comes at the price of having to re-order more frames and hold more references. This increases latency.

The type of content being captured is also very important. As MPEG-4 AVC improves upon MPEG-2 in its ability to exploit spatial and temporal redundancies, it should come as no surprise that the biggest efficiency gains are seen for video streams with inherently redundant content. News shots intrinsically require less bits to be described than complex sports scenes with highly detailed content, pans, zooms and scene changes.

So, is there ultimately a case for the utilization of MPEG-4 AVC in newsgathering? Certainly! The benefits that MPEG-4 AVC can provide, especially when coupled with DVB-S2, are actually quite significant. The algorithm is tailored to exploit the higher redundancy in newsgathering content and the lower bit-rates involved enable the benefits offered by MPEG-4 AVC to have great statistical significance compared with MPEG-2. An MPEG-4 AVC DSNG using DVB-S2 modulation can undoubtedly provide overall bandwidth savings of over 50% compared to the equivalent MPEG-2 and DVB-S pairing. With satellite bandwidth at a premium, this constitutes a concrete business case for the technology and will ensure that broadcasters effectively push for its adoption.

Moreover, there are encoders on the market today that offer operating latencies comparable to (and scarily sometimes even lower than) those of MPEG-2. As mentioned already, care must be taken in reading these delay values as a measure of performance as reducing latency beyond a certain threshold can only be done at the expense of the efficacy of the MPEG algorithm. The successful MPEG-4 AVC DSNGs will be those able to provide the best bit-rate savings at operating delays comparable to what we are used to in MPEG-2. A 100ms encoder, not using B-frames or a decent buffer size simply cannot.

TANDBERG Television's EN8040 Voyager MPEG-4 AVC HD DSNG

With broadcasters pushing for bandwidth savings, operators will start to equip their trucks and fly-aways with MPEG-4 AVC capable equipment. And although the argument for a business case for HD news still ensues, I think it is valid to notice that one could revert to the bandwidths currently used for SD services to provide newsgathering in HD.

I want to add a quick consideration for those operators that today use their equipment to cover both news and premium events (e.g. sports). The higher complexity of images from these events and the higher bit-rate and quality demands mean that the intrinsic advantages of MPEG-4 AVC over MPEG-2 naturally decrease. Although MPEG-4 AVC does provide quality enhancing features (grouped into "fidelity extensions", such as 4:2:2 support and 10-bit sampling support) these are far from common and still belong in the realm of early-adoption, with greater costs and high interoperability risks to match.

This added level of complexity can clearly leave SNG operators in a big predicament. We're at a stage now in which not moving to MPEG-4 AVC can leave an operator irremediably behind in the newsgathering market. At the same time, MPEG-2 will continue to be the standard of choice for premium content where the high bit-rates, the 4:2:2 sub-sampling, the intrinsically lower latency and the proven interoperability mean it can still perform really well at a much more competitive price point. Supporting two standards at both transmit and receive end is definitely less than desirable and it is easy to predict a move to MPEG-4 AVC across the board. But it will take time. Until then, operators willing to serve both applications will need to support both standards.

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