Challenges of launching a real full-time UHD channel on a satellite   July 2016

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Introduction

Ultra HD (UHD) broadcasting via satellite is getting popular in view of an increasing number of UHD channels demonstrating on satellites such as AsiaSat, SES, Intelsat and Eutelsat over the past two years. Most of them are free-to-air channels for promoting UHD in different countries and regions. However, among these channels only a few are *real* full-time UHD channels, i.e. without repeating the content for at least 24 hours.

The paper examines some of the challenges that broadcasters and content providers would face in launching a full-time UHD channel via satellite, and some recommendations and solutions from the industry.

Modern Workflows for UHD Broadcast Networks

UHD content can be encoded either off-line or in real time. The two workflows use different equipments with distinct interfaces and have their own pros & cons as summarised below in Table 1.

Encoding Method	Off-line Transcoding	Real Time Encoding
Pros	- Allow preview before on-air - Low cost	- High flexibility, allow real time graphics such as adding logo, live scrolling text, subtitles and even data rate - Ability to support different live applications, e.g. SNG, linear TV - Allow statistical multiplexing
Cons	- Longer time required to transcode file (e.g. 4 – 8 hours are needed to transcode 1 hour of UHD content) - Cannot change/insert information (e.g. logos, subtitles) to the transcoded file - Fixed data rate - A streamer is needed - Long QC time	- Expensive - Cannot preview before on-air

Table 1: Pros and Cons of Different UHD Encoding Methods

Off-air means transcoding UHD programmes in HEVC format first, and the transcoded file is stored and will be playout as scheduled. Off-line transcoding is usually software based. Real-time means encoding the UHD programmes in HEVC and the encoded stream is immediately put on-air. There are two different ways of UHD playout to support the workflows: playout outputs the uncompressed UHD signal via 4 X 3G-SDI for real time case and MPEG transport stream (T.S.) by IP for off-air.
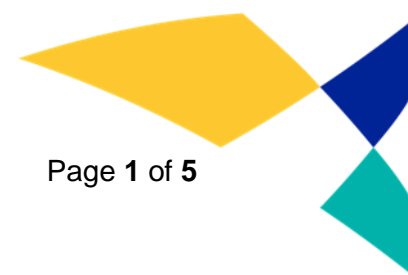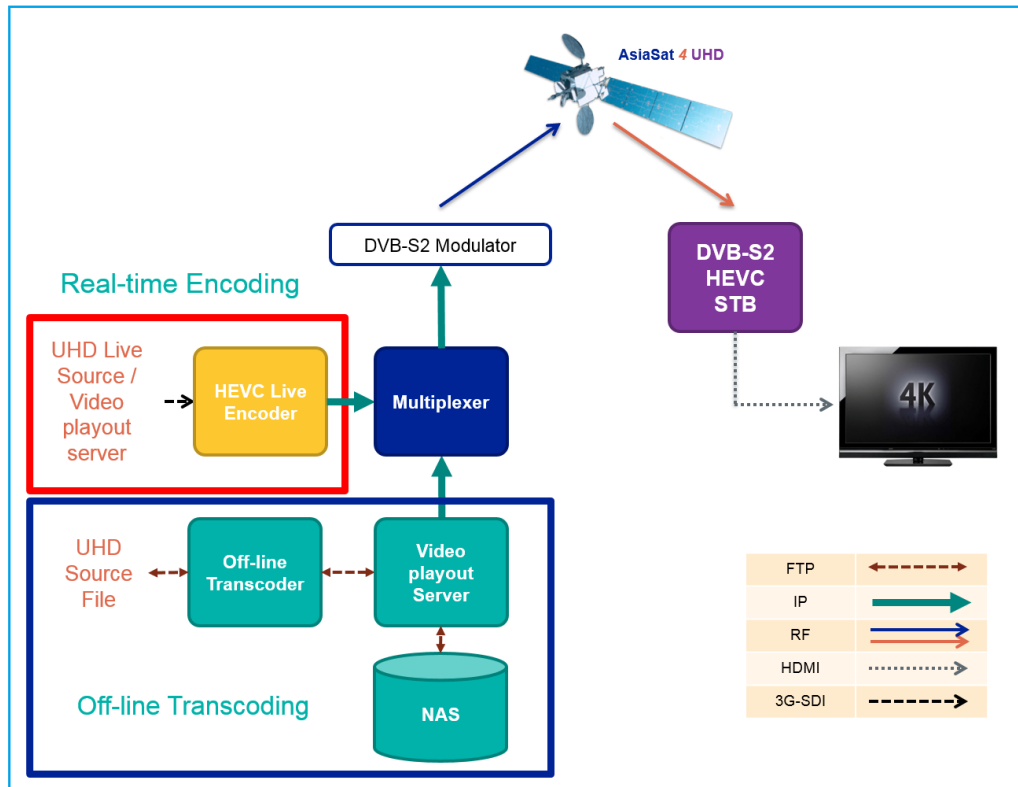
Figure 1: Block Diagram of Different UHD Encoding Methods

Challenges

The challenges in launching a full-time UHD channel, especially over satellite are:

1. Lack of UHD content:

At least several hundred hours of content is required for a full-time channel to sustain. Although native UHD shooting has been available for some years, it is still difficult to produce enough UHD content.

UHD improves the video quality for better viewing experience. However, it is not the only factor to retain audiences. One of the lessons learned during the transition from SD to HD was that "Content is King" and it still is. The best way to attract and retain audiences is to produce unique and interesting content, such as special live events, music concerts and large sports competitions. As it requires long production time to create attractive content, it will take much time to gather sufficient UHD content for the deployment of a full-time UHD channel.

2. Expensive UHD HEVC Set-top Box:

HEVC is a new encoding technology and only a few models of set-top box (STB) are available to support HEVC with UHD resolution. As a result, the price of UHD HEVC STB is much higher than that of an ordinary HD STB. Currently the price of a UHD HEVC STB varies from a hundred to several hundreds of USD. Moreover, the requirement to customise middlewares and conditional access solutions for DTH operators would further increase the cost.

As a result, the prices of UHD subscription would be much higher than that of HD, thus significantly affecting uptake of UHD services. For example, Videocon d2h, one of the major DTH service providers in India, has around 15 million of subscribers in total[1] but only 8000 to 9000 of them are UHD subscribers[2].

3. Inefficient UHD monitoring device/system:

To launch a full-time UHD channel over satellite, not only encoding equipment but also decoding devices are necessary. DTH service providers should monitor their channels to make sure all the programmes are operating smoothly.

In the past, UHD STBs and TVs were used to monitor the UHD channel, with one pair of STB and TV for each channel/programme. This, however, failed to provide any alarms or event logs for error checking or bug fixing when the channel went abnormal. Moreover, it consumed a lot of resources including manpower and physical space to monitor UHD programmes. Inefficient monitoring method has then limited the growth of UHD services on satellites.

4. Dearth of professional UHD IRD/decoder:

Professional IRDs (PIRDs) are widely used in the broadcast networks, especially for cable TV headend operation in order to provide a reliable and stable service. HEVC is the latest compression method which provides higher compression efficiency than MPEG 4. Many vendors integrate it to their PIRDs to support HD/SD service. However, only a few PIRDs in the market can support UHD resolution, and none of the HEVC PIRDs supports both UHD and conditional access features. As a result, the expansion of UHD channels over satellites has been restricted.

5. UHD video security:

One of the major concerns in launching a commercial full-time UHD service is the immaturity of UHD content protection. Despite widely recognised by many industry practitioners and the introduction of a series of security guidelines, it still needs time before vendors can design and implement chipsets and devices that fully meet the UHD security requirements.

Solutions from the Industry

Actually, the operators and vendors from the broadcasting industry have done quite a lot of works to promote UHD content development and for the deployment of UHD channels.

1. **Upscaling HD to UHD**
    Upscaling the existing valuable HD content to UHD is one of the most generally adopted solutions to expand the UHD content database. There are different products to upscale the content for both real time and pre-record HD content.
    i)   Real time
            Benefiting from the latest computer hardware and GPU capabilities, we can upscale the HD live content to UHD through software. HEVC encoding could be applied as well in the T.S. over IP output. A typical example is ArcVideo Live[3] from ArcVideo.

ii)   Pre-record
Unlike the live content, there are many solutions to upscale the pre-record HD content to UHD before broadcasting. For example, we can upscale the HD content to UHD, encode it with file transcoder and play it via playout server. One of the examples is the ProMedia Xpress[4] and Sapphire playout server[5] from Harmonic.

Another way of upscaling is to use rendering software: we can render the HD to UHD without HEVC encoding, store it in the playout server which outputs 4X3G SDI, then play and encode it when necessary. Real time HEVC encoder is required for this solution. An example is the UHD solutions from Rohde & Schwarz.

2. **Launch of UHD HEVC Professional decoders**
Many UHD HEVC decoders are available in the market, including the VH-4000 model from VILLAGE island[6]; BMM-810 from Rohde & Schwarz[7] and UHD-1000 and UHD-1500 from NTTAT[8]. These decoders can output UHD signal via 3G SDI (uncompressed) or ASI (compressed). In addition, as HEVC is still under development, most of the available decoders are software based. However, the decoders mentioned above do not support any digital content protection technologies, e.g. CA and DRM.

3. **Launch of UHD chipsets that support UHD protection specification by MovieLabs**
A growing number of UHD chipsets is available to support the Specification for Next Generation Video and Enhanced Content Protection set by MovieLabs (Motion Picture Laboratories, Inc.). SoCs (System-on-chip) from chipset vendors like Broadcom, Marvel, MStar and HiSilicon fulfills protection specification and has received the Verimatrix ViewRight Security Certification for UHD-capable chipsets[9].

With the launches of these new UHD chipsets, STB and TV manufacturers can design their own systems/solutions that fully support the UHD security.

4. **Availability of UHD monitoring system**
UHD monitoring system available in the market is providing more flexible and better features. For example, Kaleido-MX 4K multiviewer from Grass Valley[10] and the IP based multiviewer called Supervisor from ArcVideo[11]. Their products support HD/SD videos and can downscale the UHD video to HD or even SD, which can reduce the cost of monitoring devices. Furthermore, they integrated with alarm servers which can provide completed monitoring service for full-time UHD channels.

Conclusion

There is no doubt that full-blown commercial UHD services will be the future trend of satellite TV market. NSR's latest report on *UltraHD via Satellite* forecasts that there will be 785 UHD channels on satellites by 2025. The additional leasing revenues of these intensive UHD channels will top $280 million annually[12].

However, the rapid growth of UHD channels over these two years is not expected. As the specification of UHD-1 Phase 2 is not yet finalised by ITU, the current UHD format is just a milestone of the UHD-1 standard. Broadcasters are expected to launch their UHD full-time commercial services only after the finalisation and implementation of UHD-1 standard to minimise the migration cost.

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