UHD Update: Format Improvements, Service Delivery Challenges, and Solutions
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When it comes to defining the ultimate video viewing experience, consumers have spoken! Video quality is important. According to ABI Research, UHD TV penetration is expected to reach 61 percent in North America by 2020, which is higher than expected. On a global scale, consumer demand for 4K TV sets will increase at a 72 percent combined annual growth rate until 2018, with China accounting for a staggering 70 percent of worldwide 4K TV demand, based on recent research from Futuresource Consulting.

As the UHD environment continues to heat up, with additional services deployed and format enhancements underway, it is an exciting time for the television industry. Delivering UHD services will help video content and service providers differentiate their service offering to improve viewer satisfaction, attract new customers, and increase revenue streams. Yet, UHD is not without challenges. For instance, an end-to-end UHD ecosystem still needs to be defined, and the industry is in dire need of a backwards compatibility plan for Phase 1 UHD TV sets.

This article will examine improvements that are currently being made to the UHD format to transform the television experience. It will also describe the technical issues involved with delivering UHD, while taking a look at the technologies and industry consortiums that are paving the way toward enabling worldwide deployments.

The Evolution of the UHD Format
Phase 1 of the UHD standard offers a significant enhancement in resolution over HD, about four times more pixels compared with 1080p60. However, beyond resolution, the video format is fairly limited. Since the average television viewer has a cap on bandwidth, the increase in video quality is barely visible when stacked up against 1080p 50/60 fps or Blu-ray content (1080p24). That is an issue that several standards bodies around the world are currently looking to address.

Right now Phase 2 of the UHD standard is being developed by SMPTE, MPEG, ATSC and DVB for broadcast applications. A major focus area for these groups is defining specifications for Wide Color Gamut (WCG), High Dynamic Range (HDR), High Frame Rate (HFR) and Next-Generation Audio (NGA). Adding these advanced features to the format will greatly improve the
UHD viewing experience. They are also looking to create a backwards compatibility scheme to support Phase 1 TVs (HDMI 2.0 capable). Without this compatibility scheme, consumers who own Phase 1 TVs will not be able to enjoy the new features offered by Phase 2 of the UHD format.

Making HDR and WCG mandatory components of the UHD format will enable the industry to support a much broader range of color and brightness than what is currently available through any broadcast, Blu-ray or cinema systems. HDR, in particular, improves the contrast, creating a wider range between the whitest whites and blackest blacks. Ultimately, this creates a sharper viewing experience.

**Technical Delivery Challenges With UHD**

Despite the fact that there are a few VOD and live UHD services available today, the majority of video content and service providers have been reluctant to announce plans for an UHD service. There are several reasons for this. Many are waiting for Phase 2, which promises more advanced features and backwards compatibility with Phase 1 TV sets. Furthermore, premium content protection is not available yet. Beyond that, UHD production and delivery workflows need to be better defined, and an end-to-end ecosystem should be established before we can expect to see mass deployments.

Migrating to an IP-based headend would streamline UHD production and delivery workflows, increasing operators’ flexibility, scalability and cost savings compared with traditional architectures. Leveraging IP technology, service providers could quickly and easily deliver UHD services to an installed base of UHD TVs. This has already been successfully demonstrated by OTT providers such as Netflix and Amazon.

From a workflow perspective, live transmission can be made either via direct broadcast (i.e., over the air, DTH, cable, IPTV) or using an IP delivery mechanism. Content providers have several methods of disposal for delivering UHD, including traditional broadcast, MPEG-DASH and ABR multicast. While live content can be transmitted as unicast IP data to TVs with a UHD decoding capability, ABR multicast technology may be the most scalable approach toward delivering live UHD content to a large audience. As far as transcoding goes, non-linear content can be transcoded in either single bitrate for delivery over QoS-enabled IP networks (i.e., cable or telcos) or in multiple bitrates for delivery across the open Internet (i.e., OTT).
Technology Solutions and Industry Groups Driving UHD Acceptance

There are several advanced technologies that, when utilized, will make it simpler and more cost-effective for video content and service providers to distribute UHD services. One technology that resolves service providers' bandwidth limitations is HEVC. The next-generation video compression standard dramatically reduces the data rate required for high-quality video coding. This, in turn, enables service providers to deliver higher quality services such as UHD using the same amount of bandwidth. As more operators begin adopting HEVC solutions, we will see live UHD offerings including live content like premium sporting events, materialize.

Another technology that will help facilitate the emergence of UHD services is MPEG-DASH. In today’s multiscreen world, consumers demand high-quality video content on a wide array of devices, including TVs, PCs, smartphones, and tablets. Yet, packaging, storing and delivering UHD content in a variety of ABR formats (e.g. Apple HLS, Microsoft Smooth Streaming, and Adobe HDS) is too complex and expensive. The industry needs a more efficient adaptive bitrate streaming technique. By enabling service providers to package, store, and deliver a single piece of UHD content just once, MPEG-DASH eliminates scalability and cost issues.

In addition to next-generation technologies like HEVC and MPEG-DASH, there are several industry consortiums that have been created to streamline the deployment of UHD services worldwide. One group that has been active in this area is the Ultra HD Forum. A main goal of the forum is to establish guidelines for the implementation of UHD technologies, including WCG, HDR, HFR and NGA. The forum is also committed to defining an end-to-end video production and delivery chain for UHD services, for both live and VOD content. Along these lines, the forum has recommended that video content and service providers adopt an IP-centric infrastructure to facilitate this process.

At IBC2015, the Ultra HD Forum will conduct a MasterClass focused on the use of UHD technologies to deliver the next-generation consumer experience. The class takes place Friday September 11 in Rooms G102/G103 at the RAI from 4:00 p.m. to 5:30 p.m. and is open to all show attendees. A wide range of speakers will share insight into UHD technologies, including operators, major technology companies, and standards bodies. The Ultra HD Forum will also be on hand throughout the show to discuss forum membership and issues related to the UHD format.
Founded in May 2015 by Dolby Laboratories, Ericsson, Harmonic, LG Electronics, NeuLion and Sony, the Ultra HD Forum now includes 20 member companies. Working together, they are driving forward the global deployment of live and non-linear UHD content to enable the ultimate television experience.

Conclusion

UHD service deployments are just on the brink of going global. By the year 2017-2018, the industry can expect to see a flurry of commercial UHD service deployments.

Thanks to the hard work of the Ultra HD Forum and other industry groups, content and service providers will soon have an end-to-end UHD delivery ecosystem for distributing live and non-linear UHD content in its full glory. This ecosystem will cover all aspects of UHD production and delivery from OTT to QoS, push VOD, nVOD, adaptive streaming, live, and on-demand. The end result: Television viewers can enjoy advanced features like HDR, WCG, and more.

In addition to developing specifications for advanced technologies like WCG and HDR, the forum is working on setting up interoperability tests, plug-fests and trials to demonstrate the usability and comprehensiveness of UHD and related media standards. More information about the Ultra HD Forum can be found at www.ultrahdforum.org.

Harmonic has developed a guidebook on UHD that will help the reader go deeper into learning about Ultra HD: http://info.harmonicinc.com/Ebook-UHD-Guidebook

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