Ultra HD Playout & Delivery

SOLUTION BRIEF

The next major advancement in television has arrived: Ultra HD. By 2020 more than 40 million consumers around the world are projected to be watching close to 250 linear UHD channels, a figure that doesn't include VOD (video-on-demand) or OTT (over-the-top) UHD services. A complete UHD playout and delivery solution from Harmonic will help you to meet that demand.

4K UHD delivers a screen resolution four times that of 1080p60. Not to be confused with the 4K digital cinema format, a professional production and cinema standard with a resolution of 4096 x 2160, UHD is a broadcast and OTT standard with a video resolution of 3840 x 2160 pixels at 24/30 fps and 8-bit color sampling. Second-generation UHD specifications will reach a frame rate of 50/60 fps at 10 bits. When combined with advanced technologies such as high dynamic range (HDR) and wide color gamut (WCG), the home viewing experience will be unlike anything previously available.

The expected demand for UHD content will include all types of programming, from VOD movie channels to live global sporting events such as the World Cup and Olympics. UHD-native channel deployments are already on the rise, including the first linear UHD channel in North America, NASA TV UHD, launched in 2015 via a partnership between Harmonic and NASA's Marshall Space Flight Center. The channel highlights incredible imagery from the U.S. space program using an end-to-end UHD playout, encoding and delivery solution from Harmonic.

The Harmonic UHD solution incorporates the latest developments in IP networking and compression technology, including HEVC (High-Efficiency Video Coding) signal transport and HDR enhancement. By leveraging our expertise in video compression, storage and transport, content and service providers gain the ability to distribute UHD assets simply, reliably and cost-effectively.

HIGHLIGHTS

- Simplified playout, encoding and delivery of live, VOD and linear UHD channels
- Support for standardized HDR formats, including HDR10 and HLG
- Adaptive bitrate streaming of UHD content with hooks to DRM and CMS

- Ingest of all popular production formats
- CiaB playout and automation
- Live single-slice encoding
- HEVC signal transport for broadcast and OTT

- Cloud-enabled transcoding
- VOD streaming via MPEG-DASH CENC DRM
- Software upgradeable to next-generation UHD features (HDR, HFR, NGA)
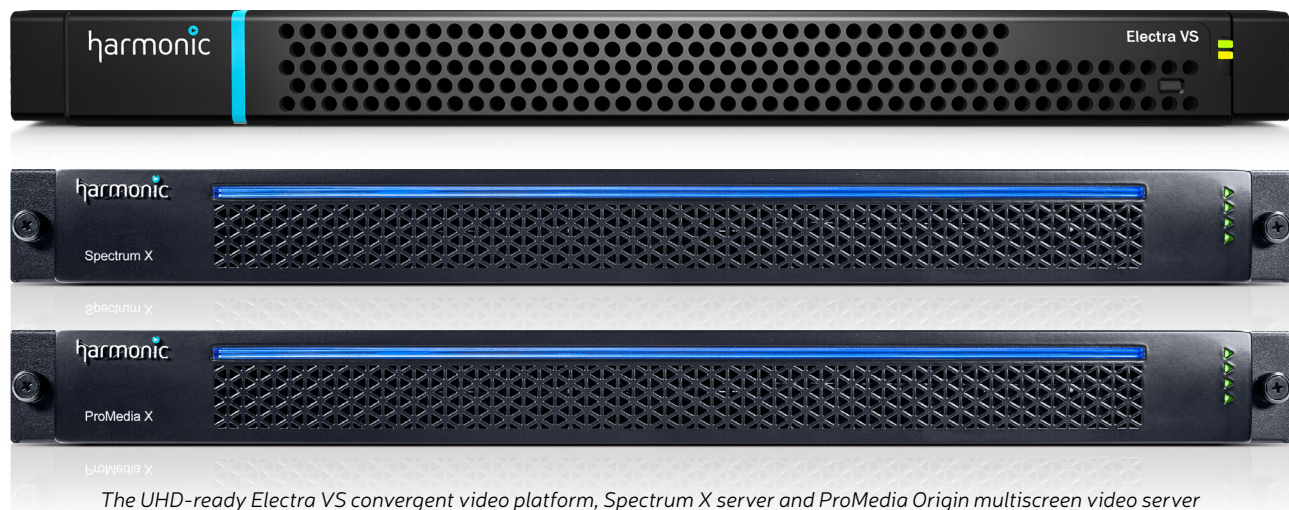
harmonic

UHD Standardization

Still in its early stages, UHD technology continues to evolve. The current set of commercial requirements, known as UHD-1 Phase 1 by the DVB, accommodates up to 60 fps at 8- or 10-bit sampling. It features standard dynamic range and conforms to ITU-R BT.709 and BT.2020 color space requirements. To date the major improvement offered by UHD is improved resolution. Many industry observers believe that the advancements outlined for UHD-1 Phase 2 — including WCG, HDR, high frame rate (HFR) and next-generation audio (NGA) — are needed for the average viewer to differentiate UHD from existing 1080p video.

The dynamic range gains available when HDR and WCG are applied to UHD may well be the driver behind widespread consumer demand for UHD content. These advancements will be especially apparent on television screen sizes above 60 inches, providing the "wow" factor consumers expect with UHD viewing. WCG and HDR technologies are just now starting to emerge through a range of differing schemes; key to the adoption of any method will be its handling of backwards compatibility with existing UHD-1 Phase 1 services.

While industry efforts for standardizing HDR technology remain a work-in-progress, the software-based Harmonic PURE Compression Engine™ at the heart of Harmonic's latest encoding and transcoding solutions simplifies their implementation as soon as they're available. Harmonic leadership in this arena is clear in the availability of HDR10, PQ10 and Hybrid Log-Gamma (HLG) HDR technologies across all of our systems powered by PURE Compression. Harmonic systems also support the Dolby® AC-4 NGA format, with support for MPEG-H coming soon.

An Integrated, Future-Proof Solution

The UHD-ready Electra VS convergent video platform, Spectrum X server and ProMedia Origin multiscreen video server

Harmonic employs existing, proven technologies to build a flexible framework for the processing of UHD services. Key to the solution are UHD-ready, real-time Harmonic systems including the Spectrum™ X advanced media server, Electra™ VS convergent video platform and ProMedia® Origin multiscreen video server. UHD HEVC contribution is available with our ViBE® CP9000 encoder, and cloud-native UHD media processing via Harmonic's VOS™ Cloud solution and VOS 360 SaaS is coming soon. Offline workflows are managed with the WFS™ file-based workflow engine and ProMedia Xpress file-based transcoder. Polaris™ playout automation and the Harmonic MediaGrid shared storage system round out the offering.

The Harmonic UHD solution integrates all phases of the broadcast chain, including file ingest, collaborative post production, encoding, high-speed transcoding and time-shift TV. This integrated approach makes it possible to stream UHD VOD content over standard IP networks with hooks to digital rights management (DRM), watermarking and content management systems (CMS), and to quickly and cost-effectively deploy a linear Ultra HD channel over existing DTH, cable and telco networks.

With a Harmonic UHD solution, content providers, broadcasters and pay-TV operators can grow their capabilities at a pace that makes sense for their business. Migrate from file-based VOD downloading to adaptive bitrate (ABR) streaming of UHD assets over the internet, and, when ready, add live broadcast UHD streaming capability, complete with logo and digital program insertion, full automation and channel redundancy.

Live UHD for Content Providers

Software-upgradeable to UHD, the Spectrum X media server simplifies the migration to a real-time UHD playout workflow. Under the management of Polaris automation, the versatile Spectrum X can operate as a channel-in-a-box (CiaB) that includes ingest, playout, and feature-rich graphics and branding, or as part of a complete Spectrum shared storage infrastructure. Petabytes of UHD content can also be accessed via the highly scalable Harmonic MediaGrid system. Connection to an Electra VS encoder is through four 3G SDI outputs.
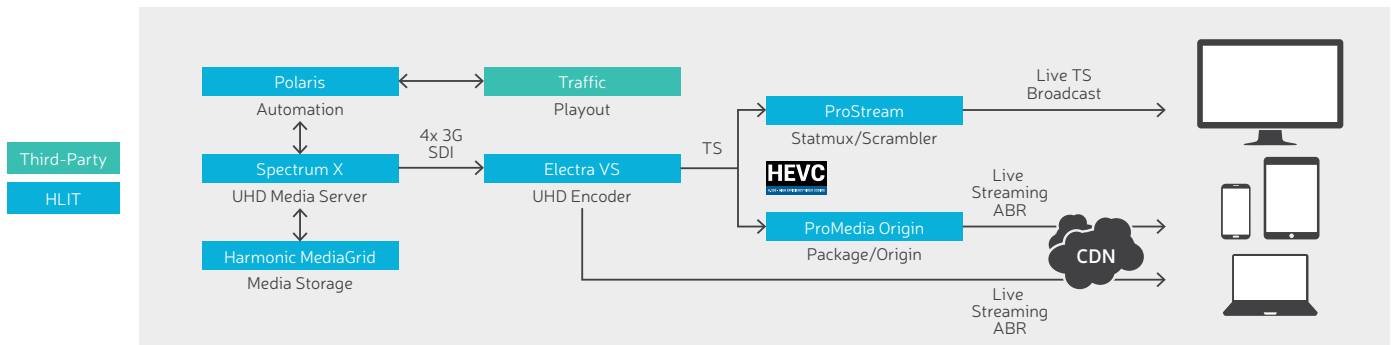
Harmonic live UHD playout workflow

Live UHD for Service Providers

Real-time UHD compression with HDR support on the Electra VS encoder lets service providers offer their subscribers the ultimate live viewing experience. Powered by the Harmonic PURE Compression Engine, Electra VS delivers superior UHD video quality at bitrates as low as 15 Mbps, supporting both live transport stream and ABR streaming workflows via HEVC. After encryption and modulation, UHD content can be streamed over cable, satellite or IPTV networks to a supporting STB, or over OTT networks using the ProMedia Origin server.
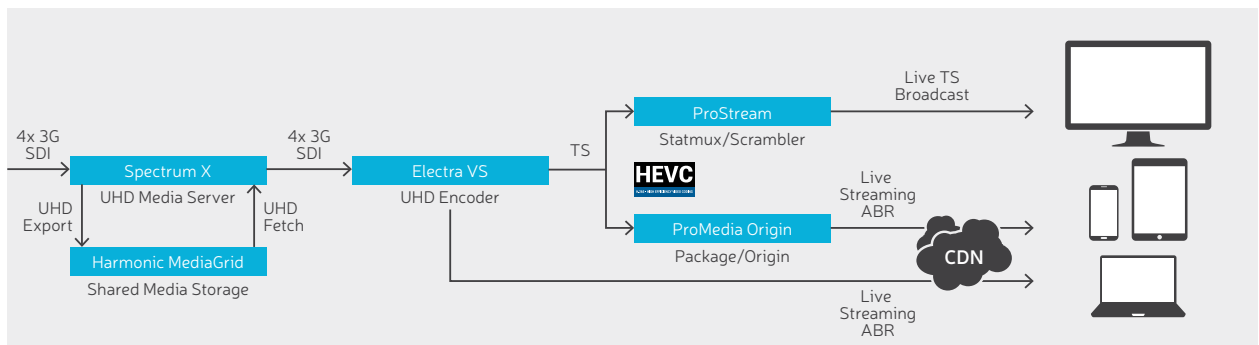
Harmonic live UHD delivery workflow

Multiscreen VOD UHD Delivery

UHD delivery over an IP network offers the competitive advantage of being able to provide consumers with UHD VOD content today. Harmonic makes it possible by leveraging the HEVC codec to reduce bandwidth while maintaining superior video quality. Powered by Harmonic MicroGrid™ parallel computing technology, ProMedia Xpress supports accelerated HEVC encoding of UHD video files. The prepared content is then sent by WFS to MediaGrid storage, ready to be streamed via ProMedia Origin to all UHD and HEVC-capable mobile and web devices. The ability to insert local and regional ads into the ABR stream helps achieve ROI on your multiscreen video streaming infrastructure.
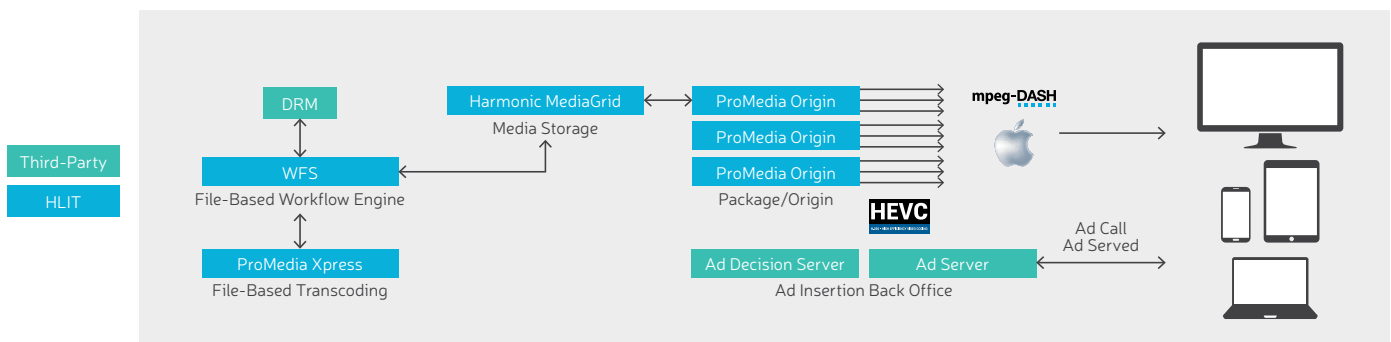
Harmonic VOD UHD multiscreen workflow

Transitioning from HD to UHD

While most new televisions today support 1080p, the majority of channels are distributed in 720p or 1080i. As UHD television sets proliferate, up-converted 1080p50/60 video can satisfy consumer hunger for improved picture quality until more UHD content is available. The 1080p format can be delivered over existing headend infrastructures outfitted with Harmonic Spectrum media servers and Electra VS encoders. Set-top boxes (STBs) with the ability to decode both 1080p50/60 and UHD complete the chain. When rendered on a UHD screen, the improved resolution of 1080p50/60 over 720p — or the removal of interlace artifacts from 1080i — affords a very high-quality viewing experience.

Harmonic-Powered UHD Innovation

A founding charter member and chair of the Ultra HD Forum, Harmonic is a trusted partner in helping many of the world's leading content and service providers deliver UHD content to their viewers. Among our industry firsts:

Inter BEE International Broadcast Equipment Exhibition

Demonstrated the first consumer-grade, end-to-end UHD 60-Hz broadcast workflow, featuring ProMedia Xpress, at the Inter BEE 2013 show in Tokyo.

Electra VS

Introduced the industry's first full-frame, multi-profile UHD encoder, Electra VS, in 2015.

NABSHOW

Demonstrated live, linear UHD content delivery for cable operators at the 2015 NAB Show, featuring transport of UHD content via satellite to cable headends by SES.

CES | ibc

Demonstrated a live UHD workflow with Dolby Vision and HDR10 at IBC2015, with HLG at CES 2016, and with Technicolor HDR at IBC2016.

NASA UHD

Produced the first consumer UHD channel in North America, NASA TV UHD, powered by an end-to-end UHD delivery system from Harmonic.

5 WRAL

Participated in first commercial trial of new ATSC 3.0 standard with WRAL-TV's broadcast of a 4K/UHD documentary, encoded using the Harmonic PURE Compression Engine, in June 2016.

Ultra HD Forum Phase A Definition

Spatial Resolution	1080p or 2160p
Video Codec	HEVC Main 10, Level 5.1
Minimum Resolution	1920x1080x60
Maximum Resolution	3830x2160x60
Frame Rates	24, 25, 30, 50, 60
Sampling	10 bit
WCG	BT.2020, BT.709
HDR	SDR, PQ10, HLG
Audio Channels	Stereo 2.0 or 5.1 surround, or channel-based immersive audio
Audio Codecs	AC-3, E-AC-3, HE-ACC, AAC-LC
Subtitling	CTA-608/708, ETSI EN 300 743, ETSI EN 300 472, SCTE 27, IMSC1
Transmission	Broadcast (TS), Multicast (IP), Unicast Live and On-Demand (DASH ISO BMFF)
Broadcast Security	AES or DVB-CSA3, using a minimum of 128-bit key size
IPTV/OTT Security	AES as defined by DVB
Backward Compatibility	Headend and decoder-based PQ10: simulcast or decoder-based HLG10: built-in

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