

End-to-End UHD HDR Video Delivery

SOLUTION BRIEF



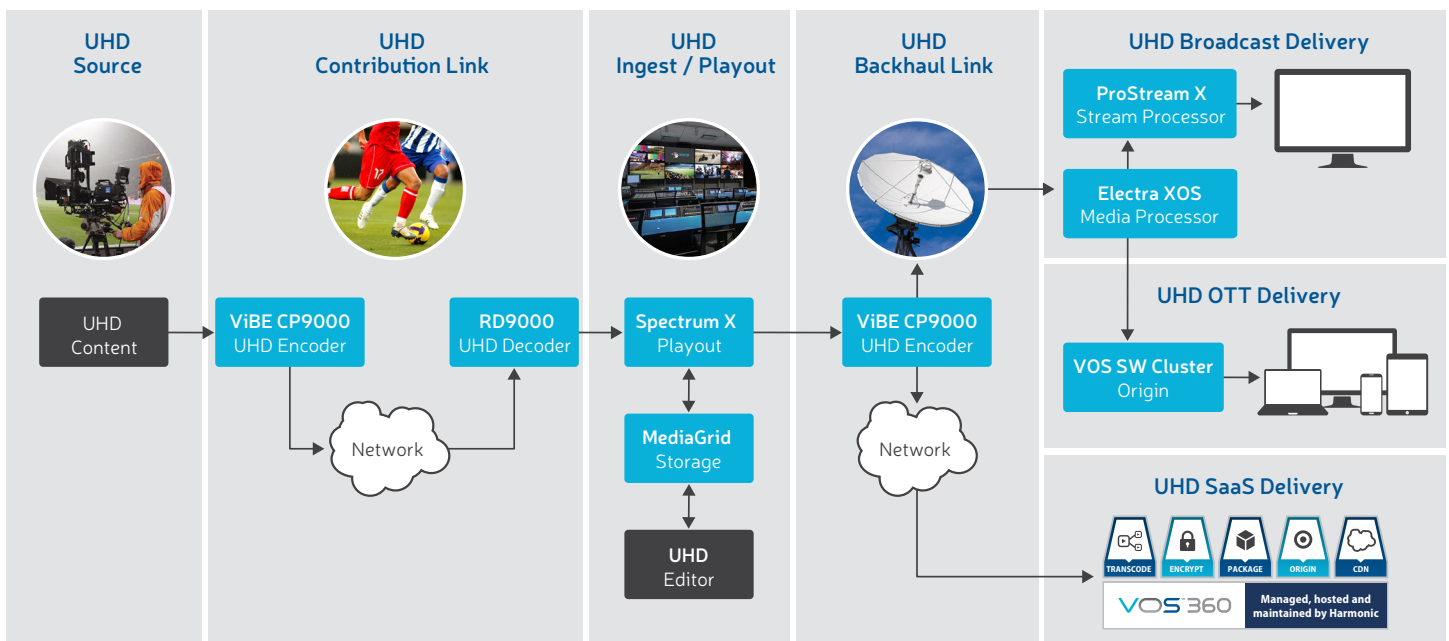
The addressable base of 4K UHD TVs with HDR is widening and starting to reach a critical mass. As of 2018, around 80 percent of UHD TVs are HDR ready. In Western Europe, 10 percent of households already have a UHD TV, and this will increase up to 32 percent in 2021. ⁽¹⁾

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 a frame rate of 50/60 fps at 10 bits color sampling. When combined with advanced technologies, such as HDR and WCG, the home viewing experience will be unlike anything previously available.

Around 70 unique linear UHD channels are already available worldwide and this number is expected to grow to more than 250 by 2020. At the moment, these channels are mostly available in Western Europe and by satellite DTH. They are then transcoded by cable and IPTV/fiber operators and delivered to the home. More than 250 types of UHD file-based content is presently being distributed by OTT providers like Amazon and Netflix. ⁽²⁾

As a founding member of the Ultra HD Forum, the global organization responsible for promoting market adoption of UHD, Harmonic is at the forefront of UHD viewing experiences. The Harmonic end-to-end UHD HDR solution, which has largely been adopted by OTT players and broadcasters worldwide, incorporates the latest developments in IP networking and compression technology, including HEVC encoding and HDR advanced processing. Content service providers can distribute UHD assets reliably and cost-effectively by leveraging our expertise in contribution, ingest, playout and storage as well as video compression and delivery to main and second screens.

The entire UHD HDR workflow can be deployed on appliance, virtual machines, customer supplied hardware, in the public or private cloud, or as a SaaS solution.



(1)(2) IHS Markit, The UHD Market, November 2017

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1. RELY ON HARMONIC ULTRA-LOW LATENCY CONTRIBUTION SOLUTION

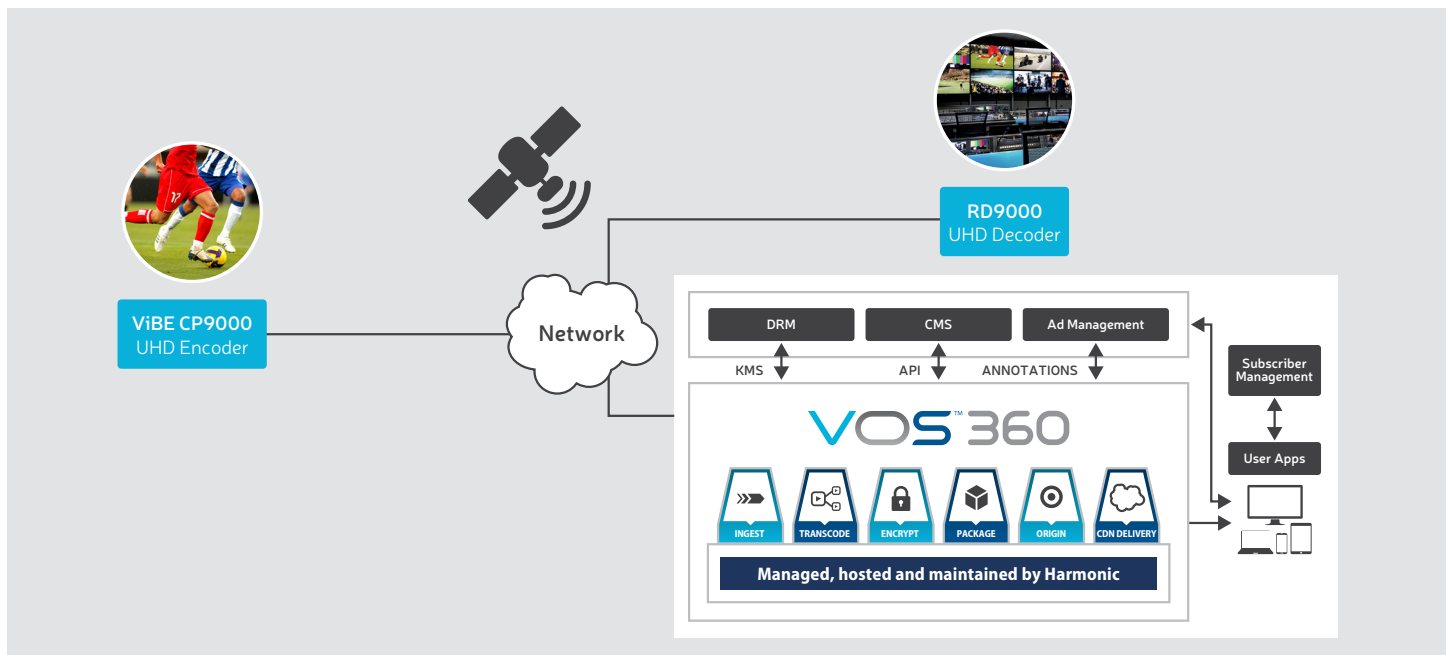
For major sports events the live feeds are usually produced with a hybrid UHD HDR and 1080p SDR solution.

Both UHD HDR and HD SDR signals are contributed from the venue using the low latency mode of Harmonic's ViBE® CP9000 HD/UHD contribution encoder. The UHD HDR signal is typically encoded at 100Mbps using HEVC 4:2:2 10 bits when the HD SDR signal is encoded at 25Mbps.

Both live signals are made available:

- To broadcasters in their production facilities. RD9000 decoders will output the live signals uncompressed in their original HDR format, like HLG or HDR10.
- In the public cloud where VOS™ 360 cloud media processing services transcode and stream live signals using CMAF with small chunks for low-latency OTT delivery (down to 5 seconds end-to-end latency) to any device.

Contribution Workflow



Contribution Products

- ViBE CP9000 HD/UHD Contribution Encoder
- RD9000 UHD HEVC Professional Decoder

CONTRIBUTION HIGHLIGHTS

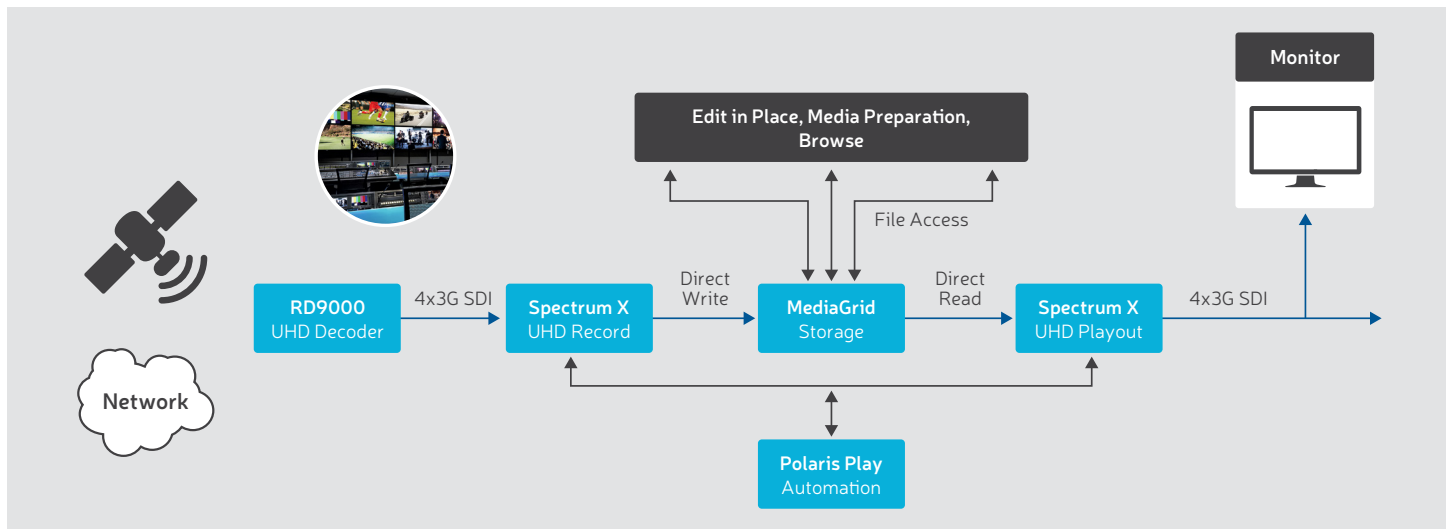
- Single-slice encoding
- As low as 300ms end-to-end latency for remote production
- Robust and reliable ingest in the public cloud
- Advanced processing (scene cut detection, de-blocking, asymmetric motion partitioning)
- Support of HD, UHD, HEVC and AVC

2. BENEFIT FROM A COMPLETE UHD PRODUCTION: RECORD, EDIT, PLAY

UHD live content can be ingested from multiple sources, including feeds from UHD cameras, UHD contribution feeds decoded by Harmonic's RD9000 or a record output of any master switcher, all through 4x 3G-SDI inputs. Each Spectrum™ X advanced media server supports a single channel record, and the live content is recorded on either an internal and/or on shared storage. Using MediaGrid for UHD content storage allows other Spectrum X servers to access the content directly without the need for a media asset management to move the content around.

This UHD ingest capability is supported via the Spectrum Player API and is compatible with Polaris™ Play channel-in-a-box automation system or any third-party automation and production application. HDR signaling is preserved throughout the entire workflow.

Playback, Production and Storage Workflow



Playback, Production and Storage Products

- RD9000 UHD Decoder
- Spectrum X Advanced Media Server System
- MediaGrid Shared Storage
- Polaris Play Channel-in-a-Box Automation System

PLAYOUT AND PRODUCTION HIGHLIGHTS

- Grow as you go and scale to your needs
- Support UHD HDR and 1080p SDR simulcast with independent graphics and branding
- Industry-leading reliability
- Instantly share content and edits
- Ingest all popular production formats

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3. ENCODE, SCRAMBLE AND PACKAGE FOR BROADCAST AND OTT DELIVERY

For broadcast delivery, Harmonic’s Electra™ XOS media processor can process any 4x3G-SDI or TS over IP incoming signals and encodes it in HEVC at 15Mbps to 20Mbps. It delivers sharp and pristine picture quality thanks to Harmonic’s PURE Compression Engine™ and supports statistical multiplexing between UHD channels and/or a mix of HD AVC and UHD HEVC.

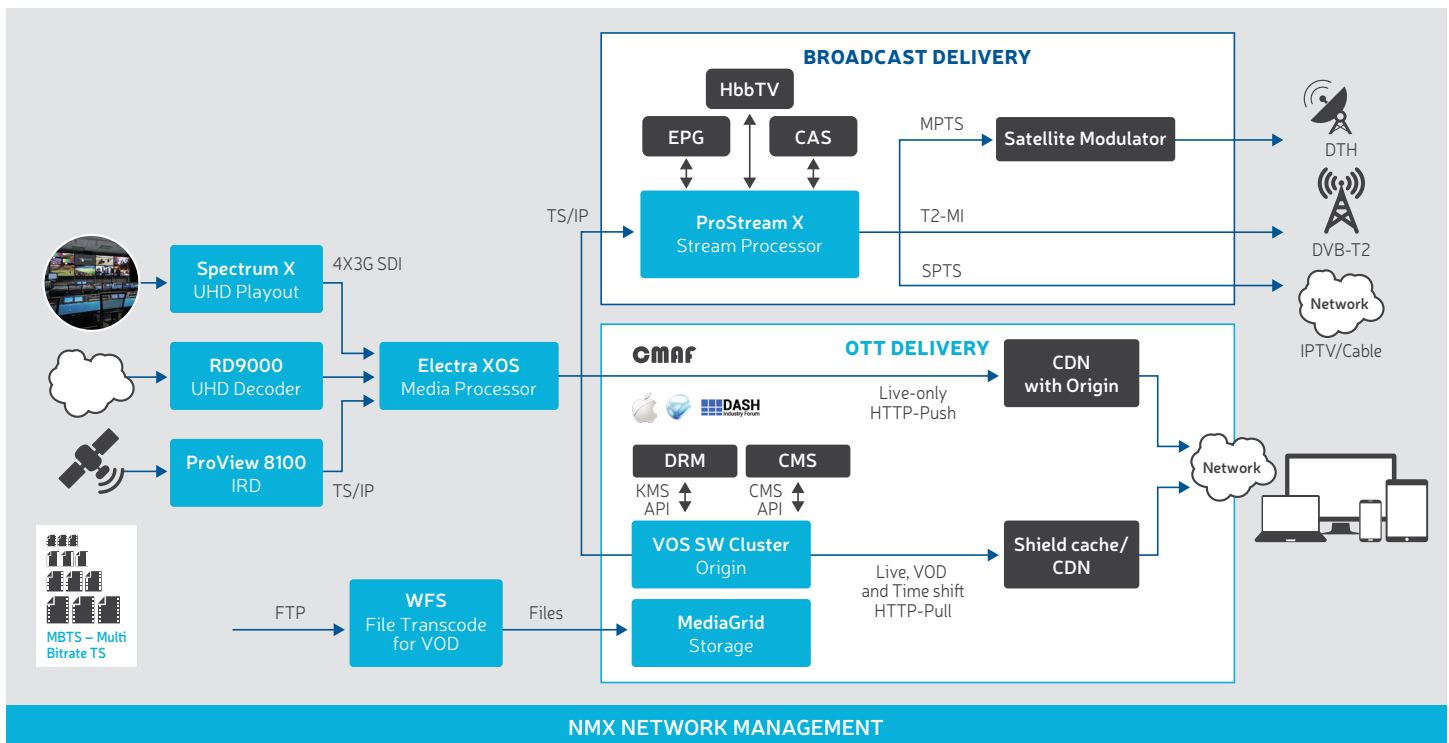
It also offers advanced HDR processing capabilities as a built-in licensed feature (SDR to HDR tone expansion, SDR encapsulation in HDR container, HDR cross-conversion and tone mapping for HDR to SDR down-conversion) that provide easy and flexible HDR management.

For broadcast delivery, Harmonic’s ProStream® X video stream processor and gateway supports DVB CSA v3 encryption on UHD live content for better content protection. This software-based multiplexer and scrambler also interfaces with any EPG generator and HbbTV data insertion.

For OTT delivery, the same Electra XOS media processor encodes live feeds and packages them using a built-in packaging feature. For OTT encoding, Harmonic’s EyeQ™ content-aware encoding technology delivers significant bandwidth savings, without requiring investment in network and subscriber infrastructure.

Streaming outputs can be connected either to a CDN for live-only HTTP push services or to VOS SW Cluster for VOD, time-shifted HTTP pull and live services. Both the built-in packaging feature and VOS SW Cluster support the CMAF packaging format for HLS and DASH delivery of UHD content as well as the low-latency OTT delivery feature based on CMAF small chunks that are key for streaming sports events over the internet.

Distribution Workflow



Distribution Products

- Electra XOS Media Processor
- ProStream X Video Stream Processor and Gateway
- VOS SW Cluster Cloud Media Processing
- MediaGrid MediaGrid Shared Storage

DISTRIBUTION HIGHLIGHTS

- Sharp and pristine pictures thanks to PURE Compression Engine
- VBR, CBR, and ABR EyeQ content-aware encoding
- Full HDR processing as a built-in feature of our UHD encoding solution
- DVB CSAv3 encryption for better UHD content protection
- CMAF small chunks for low-latency (down to 5 seconds) OTT delivery
- Flexible deployments on commercial-of-the-shelf hardware, virtual machines, private data centers, public cloud and SaaS

Acronyms

ABR	adaptive bitrate
AVC	advanced video coding
CBR	constant bitrate
CDN	content delivery network
CMAF	common media application format
CSA	common scrambling algorithm
DASH	dynamic adaptive streaming of HTTP
DVB	digital video broadcasting
EPG	electronic program guide
HDR	high dynamic range
HDS	HTTP dynamic streaming
HEVC	high-efficiency video coding
HLS	HTTP live streaming
OTT	over the top
SDR	standard dynamic range
UHD	ultra-high definition
VBR	variable bitrate
WCG	wide color gamut