Released April 21st 2017

ULTRA HD FORUM TO DEMONSTRATE UHD WITH HDR IS REAL AT THE NAB SHOW

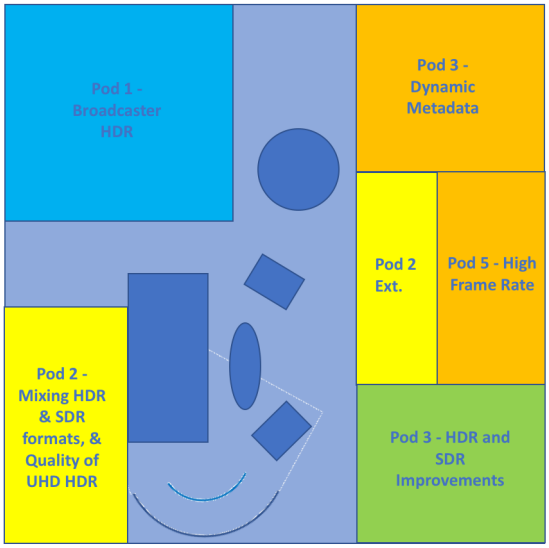
14 demonstrations highlighting fully operational UHD features, as well as future capabilities can be seen at booth N1131FP

The Ultra HD Forum is bringing real world UHD HDR to NAB, with 11 demonstrations of what can be done today to bring HDR to consumers in 2017 (something that we refer to as Phase A), and 3 demonstrations of the evolution of UHD for the future.

Our booth contains five themed pods where you can see demonstrations covering:

- Pod 1 - Broadcaster HDR - Phase A
- Pod 2 - Mixing HDR and SDR formats and the quality of UHD HDR - Phase A
- Pod 3 - Dynamic Metadata – Future
- Pod 4 - HDR and SDR Improvements - Future and Phase A
- Pod 5 - High Frame Rate Video – Future

These demonstrations are the result of work by the Ultra HD Forum Interop Working Group, and specifically key members from Dolby, Sony, LG Electronics, Technicolor, NeuLion, PBS, Sigma Designs, Huawei, Harmonic, BBright and Beamr.



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Pod 1 - Broadcaster HDR

Delivering Ultra HD HDR On Demand or via physical disk delivery is all very well, but it is critical to be delivered as linear television services comprising all the normal sources of video, delivered in a consistent form to the viewer. This pod provides demos that show this in practice.

DIRECTV Live HLG HDR - DIRECTV & Sony

DIRECTV, in association with Sony, bring you a demonstration of complete UHD HDR delivery to current customer equipment. The content is being encoded 'on the fly' at DIRECTV facilities and transmitted over satellite to current receiver equipment, being presented using the HLG transfer function as defined in ITU BT.2100. This provides high quality HDR imagery while maintaining full backwards compatibility with SDR 4K TVs, as shown in the demonstration which shows HDR and SDR video side by side.

An SDR 4K commercial is periodically inserted into the program demonstrating that SDR and HDR content can be combined seamlessly into the HLG encoded picture with excellent results.

Headend HDR10 to HLG Conversion - DIRECTV & Sony

In addition, DIRECTV is ingesting HDR10 based content and converting this in their broadcast center to HLG dynamically, for insertion to the DTH transmission. You can see the quality of the content regardless of TV mode of consumption.

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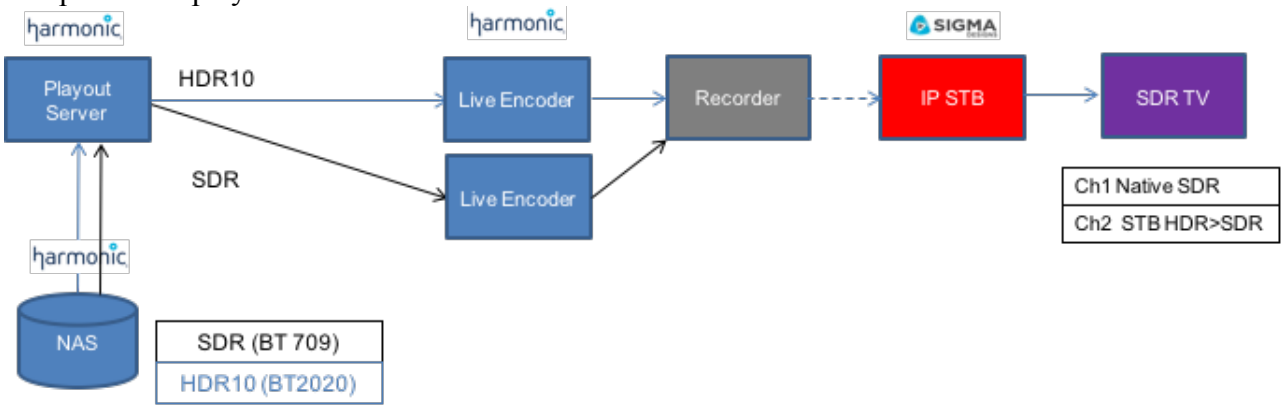
Pod 2 & Sofa Area- Mixing HDR and SDR formats and the Quality of UHD HDR

When multiple services and delivery methods provide content in a variety of forms of HDR, then adapting this content for the end device capabilities is an important requirement for the service operator, whether the tools are in the headend or client device. This pod demonstrates various operator options for these conversions.

Receiver HDR to SDR Conversion - Harmonic & Sigma

Demonstration of the capabilities of modern STB chipsets for the mapping and conversion of HDR delivered video to SDR for display on an SDR display. This is a phase A feature to allow the support of legacy display devices whilst still delivering HDR quality content for HDR compatible displays.



This is a demonstration of the capability of Sigma's latest generation SoC SMP898x to render HDR content in SDR format suitable for non HDR TVs. While content producers are rolling out exciting new HDR content, a majority of TVs in households today have not yet fully upgraded to receive HDR content. While broadcasters and content aggregators mix, match and splice HDR and SDR content, households need a backward compatible device that renders HDR content in SDR format that is compatible with current TVs. Sigma's latest generation SMP898x SoC enables STBs to offer an HDR backward compatibility function. SMP898x can convert both HDR10 and HLG content to SDR that is suitable for display on TVs without HDR capability. An OTT/IP STB, based on Sigma SoC, decodes HDR content from a local storage and sends it to an SDR TV over an HDMI 2.0b link.

ABR HDR Video Delivery - NeuLion, Sony, PBS & Dolby

Demonstration of the delivery of UHD HDR10 ABR video, including resolution and compression variation in an ABR stream.

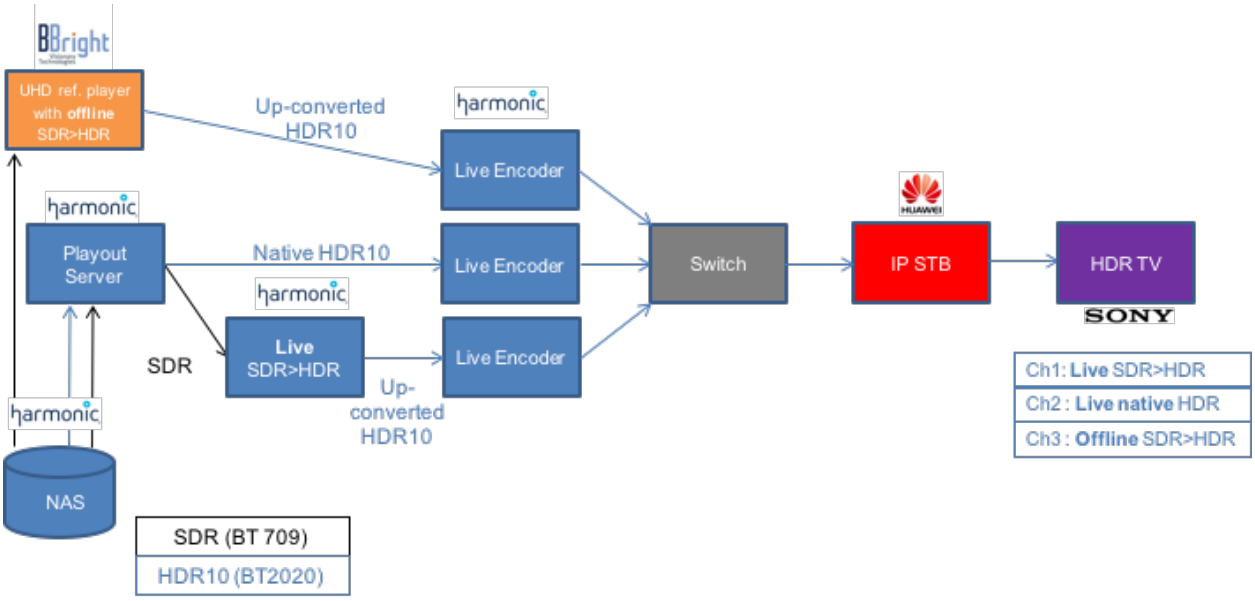
PBS and Dolby have each provided HDR content which NeuLion has encoded using multiple, resolutions and bitrates. The resolutions vary from 720p to 2160p and the bitrates vary from 1 Mbps to 18 Mbps. All versions have been encoded using HDR10 and HEVC. The videos have been segmented into a single adaptive bitrate stream using DASH. The segments are stored on a local server connected to Sony TV. An app provided by NeuLion and running on the Sony

Android Smart TV uses DASH to automatically switch between the streams as the network bandwidth varies up and down.

Multi-Resolution HDR - NeuLion, Sony & Dolby
Demonstration of HDR10 content at multiple resolutions, demonstrating the impact of better pixels rather than raw resolution with standard TV upscaling.

Dolby has provided HDR content which NeuLion has encoded using multiple resolutions and bitrates. The resolutions vary from 720p to 2160p. All versions have been encoded using HDR10 and HEVC. An app provided by NeuLion and running on a Sony Android Smart TV is used to quickly switch between each version of the video and demonstrate how the different files impact visual quality for the end-consumer.

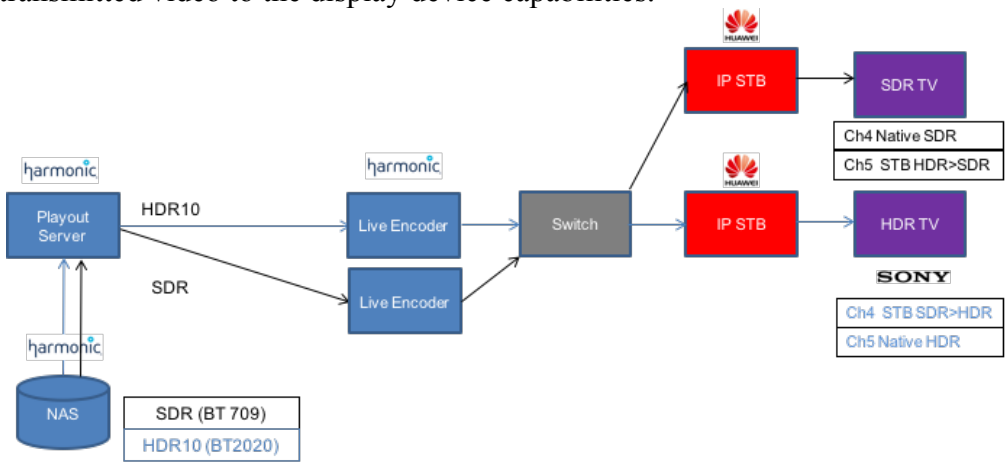
Headend and STB-based SDR-HDR - Harmonic, BBright, Huawei & Sony
Demonstration of Head End conversion from SDR to HDR10, allowing reception of HDR video even if the initial source is SDR.



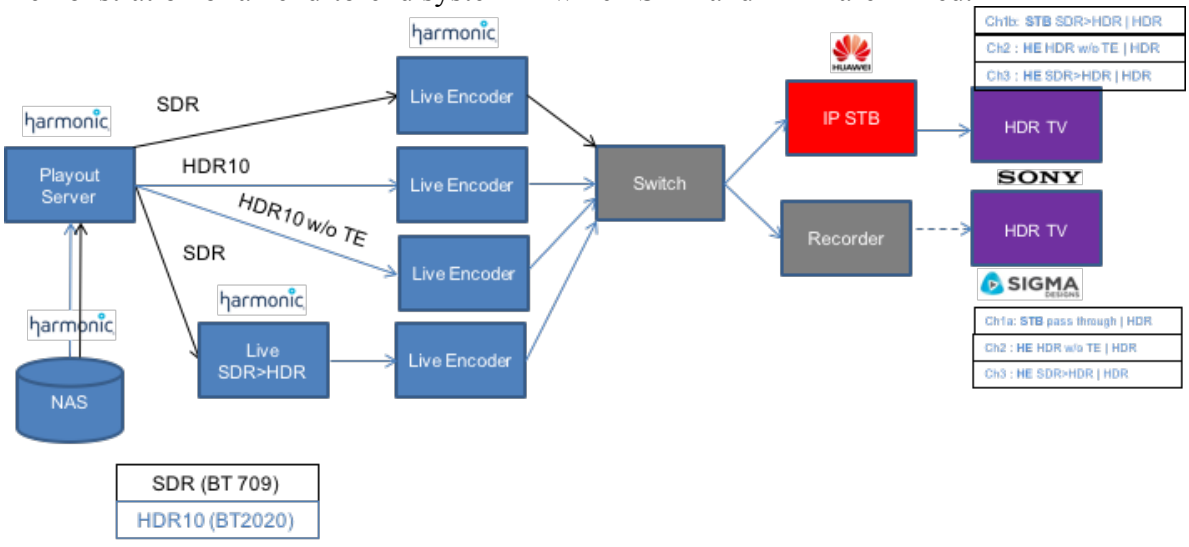
The source is SDR and the Head End applies SDR→HDR conversion using an Inverse Tone Mapping technique. The first demonstration uses a file that is converted from SDR and played out to HDR10, illustrating a file-based workflow. The second demo converts a live SDR feed to HDR10, illustrating a live workflow. These 2 demos can then be compared to the same content that has been manually graded in HDR10. Each of the demos are based on decoding by an HDR10 STB connected to an HDR10 TV.

This shows that it is possible to convert both file-based and live SDR content to provide a consistent, operator-controlled HDR experience.

As a variation of the headend variant, we also demonstrate STB based conversion from SDR to HDR and HDR to SDR, showing how an operator can make use of STB capabilities to adapt transmitted video to the display device capabilities.



SDR|HDR Decoder Behavior - Huawei, Harmonic, Sigma Designs & Sony
Demonstration of an end-to-end system in which SDR and HDR are mixed.



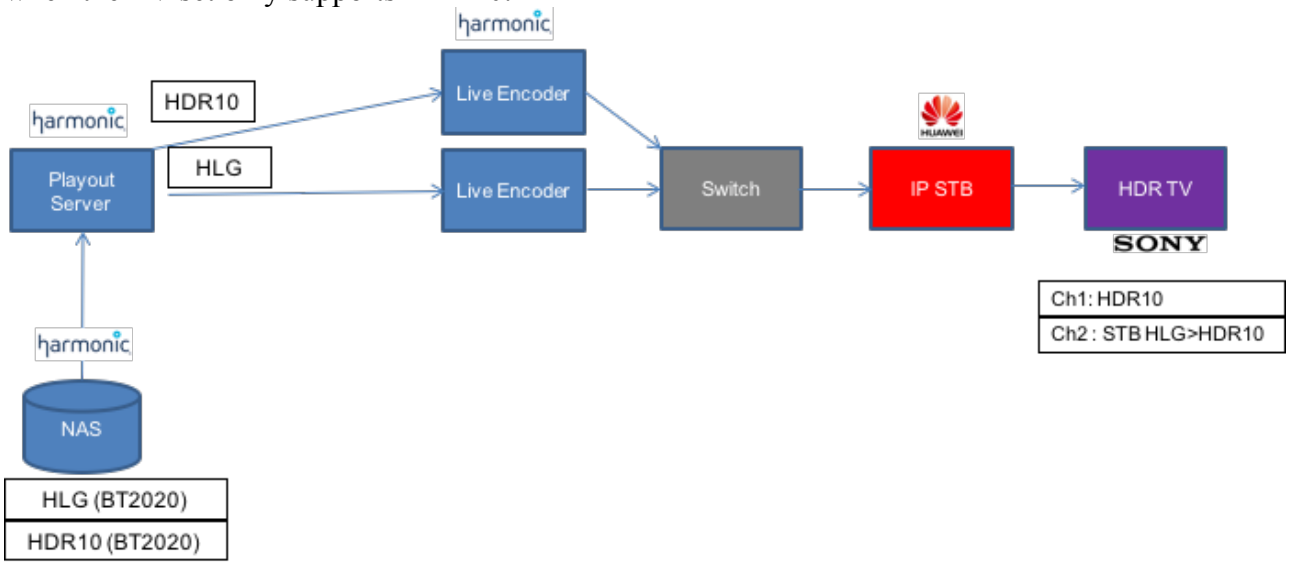
We demonstrate different ways to send a combination of SDR and HDR content. The first demo uses an SDR source in BT 709 color space. SDR can be either converted to HDR in the STB or in the TV. The second demo takes SDR BT 709 and maps it to a BT 2020 container signaled as HDR10, this provides a continuous HDR flow, without tone mapping on SDR. The last demo converts SDR content to HDR using an inverse tone mapping process. Each of the demos use decoding by an HDR10 STB connected to a HDR10 TV.

This demonstrates the different ways to mix SDR and HDR and the impact this has on the viewing experience.

Optimized UHD for Reduced Bitrates – Beamr
UHD 4K requires more bits to encode due to the 4x increase in pixels over HD. Beamr will demonstrate content-adaptive quality driven HEVC encoding that enables a higher order of efficiency for the delivery of 4K video at bitrates, close to H.264 HD.

By applying a unique, patented, perceptual quality measure, operating on the frame-level, the HEVC software encoder considerably reduces the size of video files while preserving the original video quality and staying inside the HEVC standard. This is achieved by overriding the rate control mechanism to steer the encoder at the frame-level to deliver an optimized file based on the exact needs of the video content.

Receiver Conversion from HLG to HDR10 (in Sofa Area) - Huawei, Harmonic & LG
Demonstration of Conversion from HLG to HDR10, allowing reception of mixed HDR video when the TV set only supports HDR10.



In the demo the STB has access to two video streams, one is encoded in HLG and one is in PQ. When receiving the HLG encoded video, the STB decodes and converts the HLG video stream to PQ format for presentation to the HDR10 based TV set, displaying in HDR10 mode. Switching to the PQ based stream, the STB automatically switches off the HLG→PQ conversion, decoding

and passing through the PQ signal to the TV display unaltered. Regardless of the received video stream, the TV display continues in HDR10 mode without switching its working mode.
This demonstrates part of a receiver adaption solution for transmitting HDR video regardless of whether the TV display is SDR only, HDR10 only or also HLG capable. Receiving HLG encoded video, the STB can then support any BT.2020 UHD TV display capable of SDR, HLG or HDR10. This provides a seamless experience for the consumer.

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Pod 3 - Dynamic Metadata

Metadata delivered in static, per program, form improves the overall quality of the displayed Ultra HD content. The next stage for the development of HDR is to introduce various ways of ensuring that metadata improves the overall quality of the Ultra HD content in a more dynamic way – a development that takes us to the next phase.

HDR Formats and the Benefits of Dynamic Metadata – Dolby

Not all HDR production formats are created equally and with the addition of dynamic metadata, like ST2094-10, differentiation that goes beyond the raw EOTF can be achieved.

Consumers care about image quality, especially when it comes to live sports. In this demonstration, we compare two production formats then look at how Dynamic Metadata can be used to enhance the playback experience of the broadcast signal.

The first production format is an extension of gamma, Hybrid Log Gamma (HLG), that provides backwards compatibility to TV's that support BT.2020 and new HLG TV's. Many see this as a bridge to the future and a safe step into the world of UHD/HD HDR services.

Perceptual Quantizer (PQ), the second production format, is based on the human visual system to capture more of the real world. When paired with dynamic metadata, we unlock a whole new world of possibilities where the devices, based on their own individual capabilities can produce a customized, per device experience that provides consistency and accuracy, well beyond today's traditional one-size-fits-all approach. The ability to bring out what's important in the content is what provides the "wow" and gives consumers a reason to watch from the best seat in the house, their living rooms.

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Pod 4 - HDR and SDR Improvements

Advanced HDR – Technicolor

A suite of quality-preserving technologies for bidirectional conversion between SDR and HDR images provides an efficient, backwards compatible, live production and distribution system. In live HDR production, a sports production truck encounters modern HDR cameras, legacy SDR cameras, SDR video archives, and Chyron. In addition to HDR contributions, master control must further handle commercial inventory in SDR and new commercials in HDR. SDR to HDR up-conversion, whether live or file-based, provides a consistent look and allow the remaining workflow operations to be conducted in a homogenous, HDR, mezzanine format. Just prior to emission, an artistic intent, preserving HDR to SDR down-conversion, records its own transformation parameters as metadata for distribution in the stream. When received by an SDR device, the distributed signal is rendered as a high quality SDR image, with the metadata ignored. When received by a metadata-aware STB or TV, a low complexity, metadata-driven conversion reconstructs the HDR signal for display. A collateral benefit, observed in two independent tests, is bandwidth savings of about 25%.

Display Adaptation for Various Peak Luminance Targets – Technicolor

To maintain artistic intent, HDR images graded on a mastering display having a particular peak luminance, must be adjusted before display on a target TV having a different peak luminance. The judgement of a video operator or colorist is guided by their mastering display with its particular peak luminance. When received by a TV having the same peak luminance capabilities, the image so crafted can be reproduced exactly. However, if the receiving TV offers a *different* peak luminance, the video needs to be adjusted. This adjustment should trim only highlights, *not* dim the whole image. Furthermore, color appearance (e.g., hues) should be maintained. While ST2086 Mastering Display Metadata is not strictly required, it can inform this adjustment if provided in the transport stream.

In this demonstration of a Phase A technology, the set-top box (STB) is manually adjusted to provide video a peak luminance to the TV. In practice, rather than being manually set, the TV communicates its peak luminance to the STB via HDMI, where peak luminance is a parameter communicated in the Extended Display Identification Data (EDID). Alternatively, this automatic adjustment can be built into a TV.

HDR to SDR Conversion - Technicolor

HDR video is automatically down-converted to high quality SDR in real time at the headend. A video program produced in HDR is ill-suited for direct display on an SDR TV. The transformation used to reduce the dynamic range to SDR should be optimized on a per-image basis. Otherwise, details present in some portions of the original larger range, may be compromised needlessly.

In this demonstration of a Phase A technology, the source image (HDR) is analyzed in real time to determine the transformation parameters for the target format (SDR) that best preserve the details and contrast relationships in the original image. The transformation parameters can be

provided in a transport stream as metadata that enables a low-complexity reversal of the transformation. One use for this technique is to provide an SDR simulcast of an HDR program, though a more efficient architecture is described in the Advanced HDR demonstration.

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Pod 5 - High Frame Rate Media

Ultra HD has already provided improvements in image quality by moving from the lower frame rates to 50/60fps, but there is a next step in moving beyond that. This pod shows the benefits of truly higher frame-rate content.

High Frame Rate - LG, PBS & Sony

Demonstration of the next step in UHD technology – High Frame Rate (HFR) video. HFR brings the possibility of more realistic-looking video for a minimal increase in bitrate. Particularly effective in sports and other high motion video, HFR at 1080p resolution is feasible in the near term. This demo shows HD resolution High Dynamic Range content at 120fps, and is a joint effort of LG Electronics, Sony, PBS, and Dolby.

About the Ultra HD Forum

Formed in 2015, the Ultra HD Forum is the global organization responsible for promoting market adoption of Ultra HD by defining industry best practices for the phased introduction of the wide set of technologies facilitating the next-generation television experience. With over 60 members as of April 2017, the organization facilitates interoperability testing and collaborates with industry standards bodies to align standard development activities. A list of participating member companies and additional information about the organization is available at http://ultrahdforum.org and by following @UltraHDForum.

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