

# SDR to HDR Encoding Technology

The best HDR color expansion technology in the market\*



**Plug and play with existing Standard Dynamic Range (SDR) production facilities from camera, post-production to headend**

## Embrace HDR and WCG for a lifelike viewing experience



**HIGH DYNAMIC RANGE (HDR)<sup>1</sup>**  
Extra luminance to display detailed environment highlights & shadows



**WIDE COLOUR GAMUT (WCG)<sup>2</sup>**  
Doubling color range to present a realistic visual ambience



**24/7 LINEAR CHANNEL**  
Non-stop live encoding with highly reliable Hewlett Packard Enterprise (HPE) hardware



**PERCEPTUAL RATE CONTROL<sup>3,4</sup>**  
Over 15% and 65% bandwidth saving comparing with conventional H.265 and H.264\*\* respectively

\* According to SSIM score

### Technology Patents

1. US Patent Appl. No. 15/936,459 – Method and Apparatus for Converting Low Dynamic Range Video to High Dynamic Range Video (Supports SMPTE ST 2084 defining display brightness up to 10,000 nits, 40 times brighter than conventional low dynamic range TVs of around 250 nits)
2. US Patent Appl. No. 15/936,461 – Method and System for Expanding and Enhancing Color Gamut of a Digital Image (Traditional sRGB colour space covers only 35.9% of what human vision can perceive. HERMES Live Encoder E doubles it up by supporting BT.2020 with 75.8% (or DCI-P3 with 53.6%) in the CIE 1931 colour space)
3. US Patent Appl. No. 16/016,691 – A Method for Initial Quantization Parameter Optimization in Video Coding
4. US Patent Appl. No. 16/038,154 – Method based on Coding Tree Unit Level Rate - Distortion Optimization for Rate Control in Video Coding (Actual figures may vary depending on scene complexity. Bandwidth saving may achieve better performance under certain scenarios.)



# Use Cases

Broadcaster • Live Concert • International Event



TV Broadcaster

First-ever 24/7 linear channel with HDR Color in Hong Kong



Bianca Wu Shining Moment Concert

First-ever live concert with HDR Color in Hong Kong



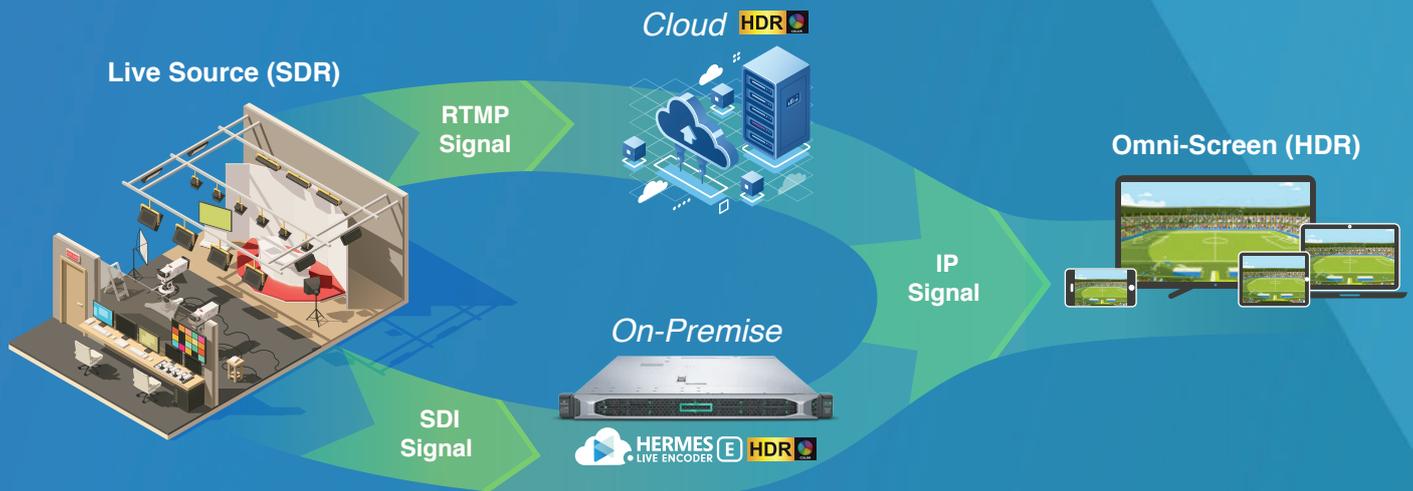
37 – 38<sup>th</sup> Hong Kong Film Awards

First-ever live streaming event in Hong Kong broadcast worldwide to 27 countries with HDR Color

“ Supported by the HERMES Live's technology, it has been the forth consecutive years to live stream the ceremony to worldwide. Never imagine the video quality can be so great with HDR Color technology. ”

The 38<sup>th</sup> Hong Kong Film Awards

## Architecture – On-Premise / Cloud



### Cloud Partners (SaaS)

- Microsoft is a registered trademark of Microsoft Corp.
- Amazon Web Services is a trademark of Amazon Web Services, Inc.
- Google Cloud Platform is a trademark of Google LLC.
- Alibaba Cloud is a trademark of Alibaba Group Holding Ltd.
- Tencent Cloud is a trademark of Tencent Holdings Ltd.

### HERMES Encoder is Qualified by the Industry

- Akamai is a trademark of Akamai Technologies, Inc.
- Apple and ProRes are registered trademarks of Apple Inc.
- Dolby Vision is a trademark of Dolby Laboratories, Inc.
- HDR10+ is a trademark of Twentieth Century Fox Home Entertainment LLC., Panasonic Corp. and Samsung Electronics Co., Ltd.

# Leading SDR to HDR Encoding Algorithm “HDR Color”



Highest score of SSIM\* is **1** presenting lifelike experience,  
TFI’s patent-pending algorithms outperform others with outstanding result **0.9736**

Method	HERMES LIVE ENCODER HDR	iTMN <sup>[1]</sup>	DrTM <sup>[2]</sup>	Huo <sup>[3]</sup>	NoDMSE <sup>[1]</sup>	NoAdvReg <sup>[1]</sup>	KO <sup>[4]</sup>
<b>SSIM</b>	<b>0.9736</b>	0.8098	0.7968	0.7707	0.7298	0.7242	0.6459

1. Research paper by Ning, H. Xu, L. Song, R. Xie and W. Zhang, "Learning an Inverse Tone Mapping Network with a Generative Adversarial Regularizer", 2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Calgary, AB, 2018, pp. 1383-1387
2. Yuki Endo, Yoshihiro Kanamori, and Jun Mitani. Deep reverse tone mapping. ACM Transactions on Graphics, 36(6): 1–10, 2017
3. Yongqing Huo, Fan Yang, Le Dong, and Vincent Brost. Physiological inverse tone mapping based on retina response. The Visual Computer, 30(5):507–517, 2014
4. Rafael P Kovaleski and Manuel M Oliveira. High-quality reverse tone mapping for a wide range of exposures. In Graphics, Patterns and Images(SIBGRAPI), 2014 27th SIBGRAPI Conference on, pages 49–56. IEEE, 2014

\* Structural Similarity (SSIM) Index is a perceptual metric that quantifies image quality degradation caused by processing

## Expand SDR into Multiple HDR Standards

	HDR10	DOLBY VISION™	HDR10+	HLG
<b>Key Differentiation</b>	Static Metadata	Dynamic Metadata	Dynamic Metadata	No Metadata
<b>Color depth</b>	10-bit and WCG	10-bit and WCG	10-bit and WCG	10-bit and WCG
<b>HDR Devices Support</b>	All devices	Apple, LG, Panasonic, Philips, TCL	Samsung, Panasonic	SONY, LG

Note: Dolby Vision and HDR 10+ can be supported by HERMES File-based Encoder

## Omni-Screen



Common mobile devices (iOS/Android phones & tablets), PCs, Smart TVs and Set-top Boxes (STB) come with HDR capable displays for HDR live video playback

# Technical Specification

## HARDWARE



### HPE ProLiant DL360 Gen10 Server

1 RU, Dimensions: 4.29 x 43.46 x 70.7 cm (1.69 x 17.11 x 27.83 in)  
Weight (approximate): 16.27 kg (35.86 lbs)

Operating Temperature: 10 to 35 °C (50 to 95 °F)  
Storage Temperature: -20 to 65 °C (-5 to 150 °F)  
Operating Humidity: 8 to 90 % - Relative Humidity  
Power Supply: Dual, Hot-swappable from Rear  
Input Range: 100 to 240 Vac (RMS), Full Range Input  
Input Frequency: 50 to 60 Hz

Hewlett Packard  
Enterprise

OEM

## INPUT AND OUTPUT

### Video

Inputs	SD/HD/3G SDI, HDMI or TS over UDP (On-Premise) RTMP (Cloud)
Outputs	Apple HTTP Live Streaming (HLS) MPEG-DASH (DASH) TS over UDP
Video Codec	H.264/AVC Baseline/Main/High Profile H.265/HEVC Main/Main 10 Profile
Audio Codec	Advanced Audio Coding (AAC)
Rate Control	Adaptive Bit Rates (ABR) with Patent-pending Perceptual Rate Control Algorithm
Resolution	Up to 4K UHD (3840 x 2160)* or Full HD (1920 x 1080)
Frame Rate	Up to 60 fps (Progressive)

### HDR Support#

Up Conversion	SDR to HDR with Patent-pending HDR Color Algorithm	
Bit Depth	10-bit	
Transfer Function	SMPTE ST 2084	
Color Space	BT.2020/DCI.P3	

\* For details of 4K UHD support, please contact our sales representatives  
# HDR live is supported under H.265/HEVC in HDR10 and HLG

## About TFI

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through innovative technology



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