HDBT™

Alliance Webinar

April 22, 2020

CEDIA™

# HDBaseT for 4K & 8K Video:

## A Glimpse at CEDIA's Latest Whitepaper

*David Meyer*
*Technical Research Consultant*

# About CEDIA

CEDIA is a global trade association for the home technology industry. It represents 3,700 member companies worldwide and serves more than 30,000 industry professionals that manufacture, design, and integrate goods and services for the connected home.

#CEDIASTRONG

# Presenter's Bio

## David Meyer

Technical Research Consultant

- CEDIA Standards & Technology department
- 25 years in home technology industry
- Video and Connectivity SME
- Worked with HDBaseT technology since 2009
- IEEE & SMPTE Professional member

HDBT™ Authorized Trainer

# About the HDBaseT Alliance

- The HDBaseT Alliance advances and promotes the adoption of HDBaseT technology as the global standard for ultra-high definition, digital connectivity.
- Since its founding in 2010 by LG Electronics, Samsung Electronics, Sony Pictures Entertainment, and Valens, the Alliance has brought together the leading names in the Consumer Electronics, Professional Audiovisual, Industrial and Automotive sectors.
- Today, the Alliance is comprised of more than 200 members, and thousands of HDBaseT products have been installed around the world.
- The cornerstone of HDBaseT technology is the convergence of ultra-high definition digital video, audio, 100BaseT Ethernet, power, various control signals, and USB over a single LAN cable.

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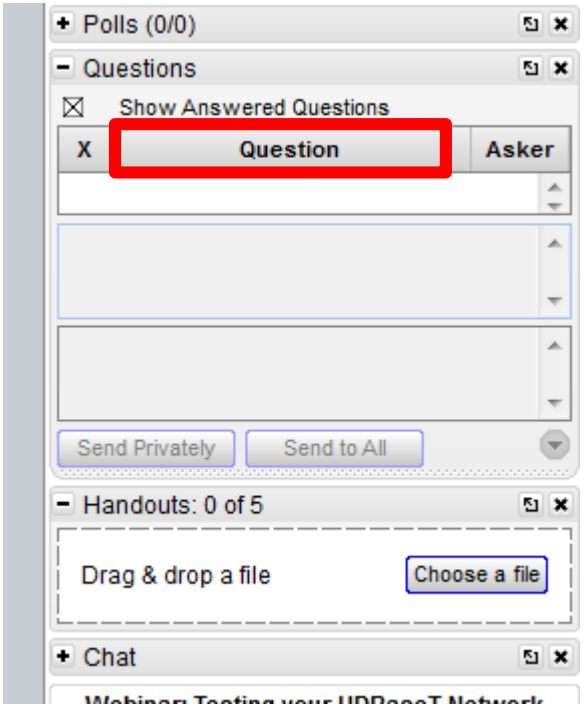
# Housekeeping




installers@hdbaset.org

CEDIA
WHITE PAPER

# HDBaseT FOR 4K & 8K VIDEO


## ABSTRACT

Entering the 2020s, the industry has seen the rise of 4K video, increasing frame rates, HDR video, and the emergence of 8K. These changes place huge demands on bandwidth, well beyond the historical, native capabilities of HDBaseT. Now HDMI 2.1 elevates the data rate to 48Gbps, so where does that leave HDBaseT? And what about AV distribution and the rise of AV-over-IP as a scalable alternative to HDBaseT and the matrix switch? This paper explores each of these challenges, including uncompressed versus compressed signaling, HDR compatibility, and HDBaseT domain switching.



## KEYWORDS

Bandwidth | Mezzanine Compression | PAM16 | Cat 6A | Matrix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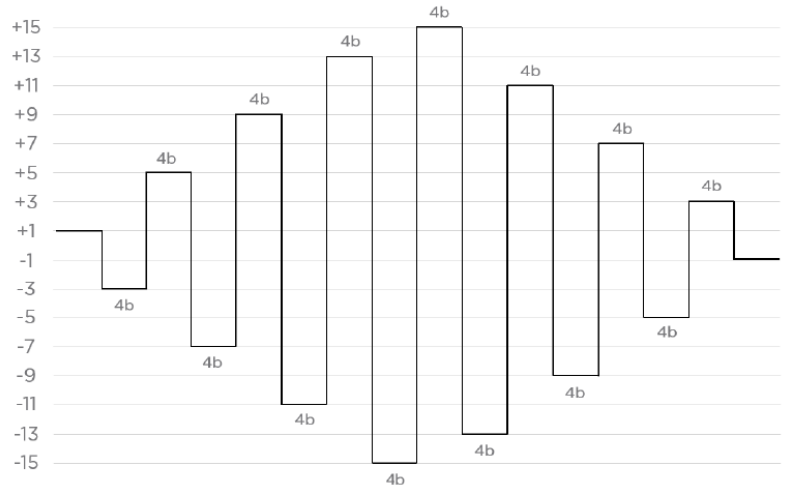
# S2: Technical Overview

## HDBaseT Signalling & Bandwidth

- HDMI vs HDBaseT
- PAM16
  - 16 voltage levels
  - 250MHz equivalent to Cat 6
  - Similar to 10GbE but not compatible
- 8Gbps native, equivalent to 10Gbps HDMI



# S3: The Bandwidth Challenge

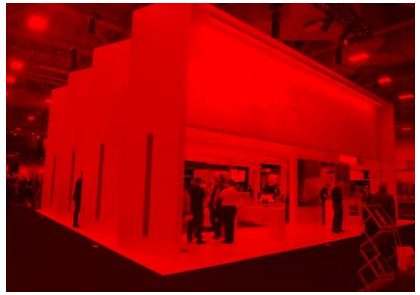
## The Marketing Interpretation Illumination

- "**4K 60 4:4:4**" marketing moniker
  - Only 8-bit, no HDR
- Who needs 4:4:4 anyway?
  - Most sources are 4:2:0
  - Gaming is native RGB
  - *…and* high frame rate (60fps+)!
  - *…and* HDR
  - *…and* need low latency

# The Bandwidth Challenge

## RGB vs YCbCr (4:4:4 / 4:2:2 / 4:2:0)

R



G

B

Y

Cb

Cr

# The Bandwidth Challenge

## HDR realities

- **HDR is the real game changer!!**
- HDR is not *just* about color
  - Mostly about grayscale (black to peak white)
  - Quantization
  - Metadata

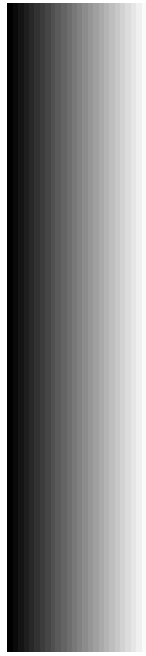
# The Bandwidth Challenge

## 8-bit SDR vs 10-bit HDR

**SDR**

0.5-100 cd/m$^2$

**8-bit (256 shades)**



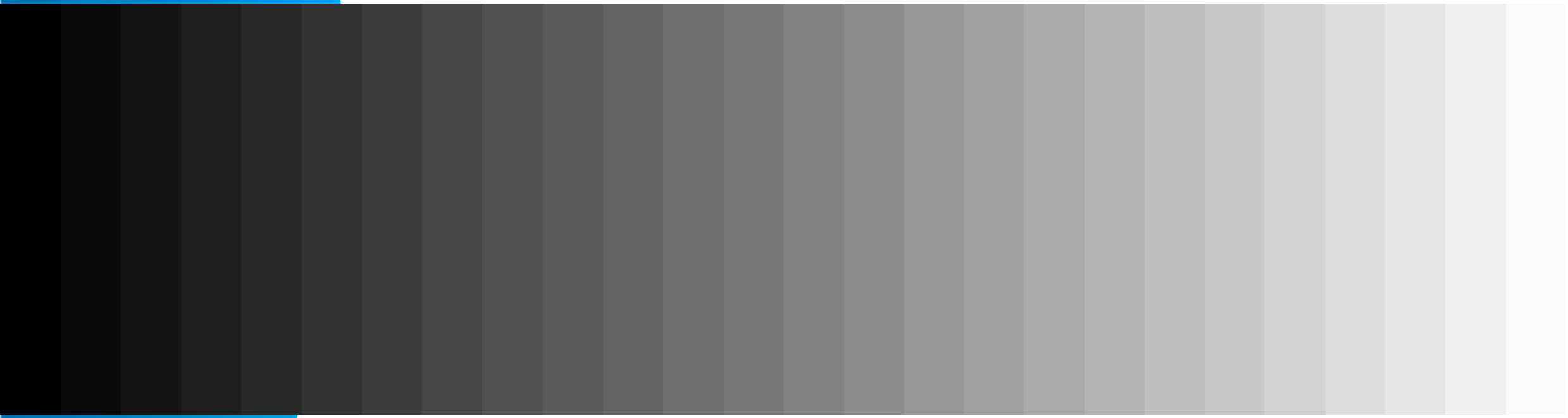
# The Bandwidth Challenge

## 8-bit SDR vs 10-bit HDR

**HDR**

0.0001-10,000 cd/$m^2$

**8-bit (256 shades)?**



# The Bandwidth Challenge

## 8-bit SDR vs 10-bit HDR

CEDIA
WHITE PAPER

AN INTEGRATOR'S GUIDE TO HDR VIDEO

Understanding and designing HDR video systems from delivery to display.

ABSTRACT

**"HDR is the biggest thing to happen to video since the introduction of color"**
*Joel Silver, ISF*

**High Dynamic Range** (HDR) video aims to meet or exceed the in-scene contrast range sensitivity of human vision. When combined with **wide color gamut** (WCG) to achieve **full color volume**, HDR delivers more realistic, true-to-life video.

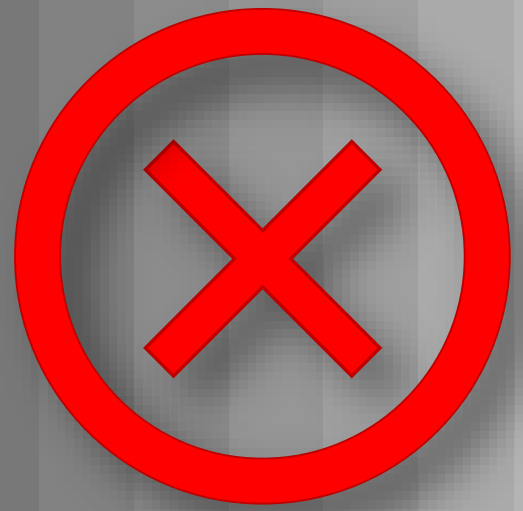
The parameters for HDR include a minimum 10-bit signal, most often accompanied by metadata so a display knows what to do with it. The implications of video resolution, frame rates, chroma subsampling, whether it is compressed or uncompressed, can all challenge the bandwidth and compatibility of the AV system and its connectivity.

This paper explores the fundamentals of HDR video and how it relates to human vision, and underlines HDR standards, formats and connectivity to ensure compatible system design and integration.

**HDR**

0.0001-10,000 cd/m$^2$

**Needs at least 700 shades!!!**



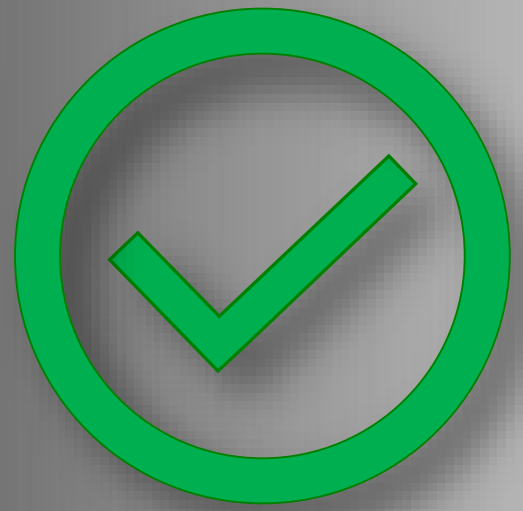
# The Bandwidth Challenge

## 10-bit True HDR

**HDR**

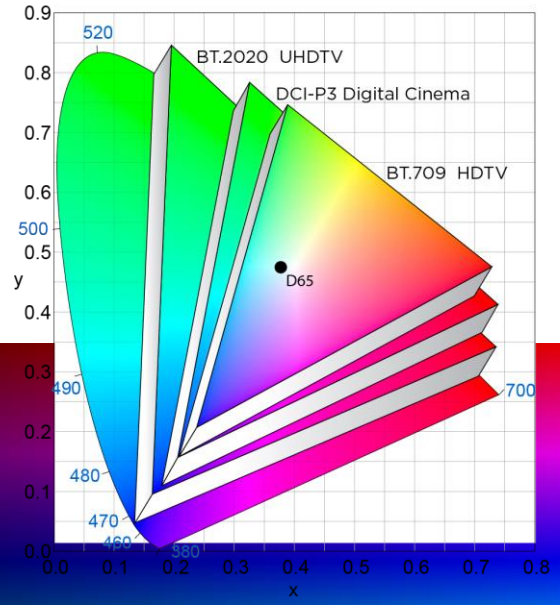
0.0001-10,000 cd/$m^2$

**10-bit (1,024 shades)**



# The Bandwidth Challenge

## Just add color!




**HDR**

0.0001-10,000 cd/m$^2$

**1 billion colors**

# The Bandwidth Challenge

## 4K HDR & HDBaseT

| 4K HDR bandwidth (HDMI): | 10-bit | 12-bit |
|---|---|---|
| 4K Blu-ray @24fps | 8.91Gbps | 8.91Gbps |
| 4K Blu-ray @60fps 4:2:0 | 11.14Gbps | 13.37Gbps |
| 4K Game @60fps 4:2:2 | 17.82Gbps | 17.82Gbps |
| 4K Game @ 60fps RGB | 20.05Gbps | 24.06Gbps |

**Needs compression!**

# The Bandwidth Challenge

## Display Stream Compression

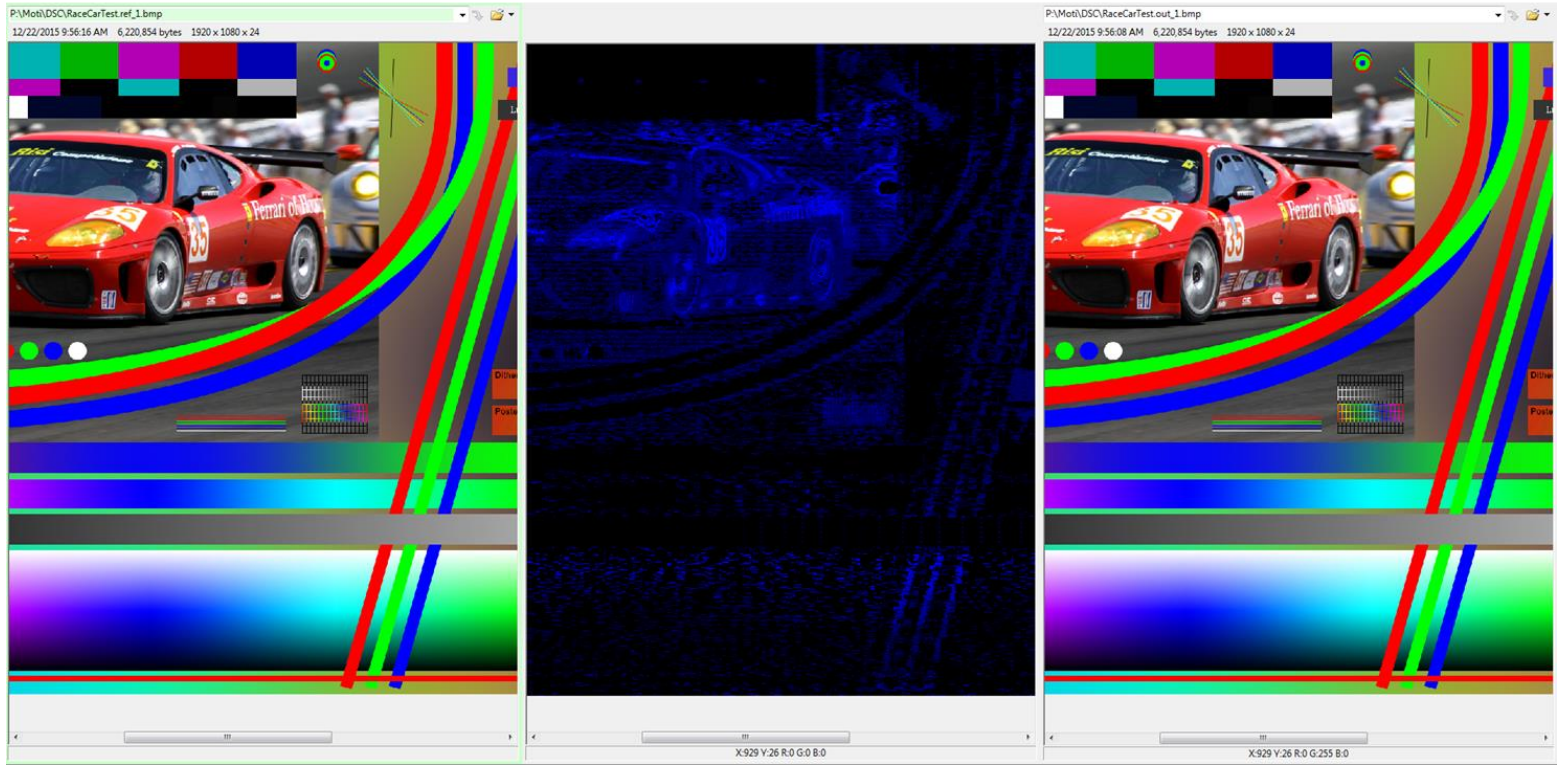
**Original**

**Diff**

Same Minor Bigger

**DSC Compressed**

VESA



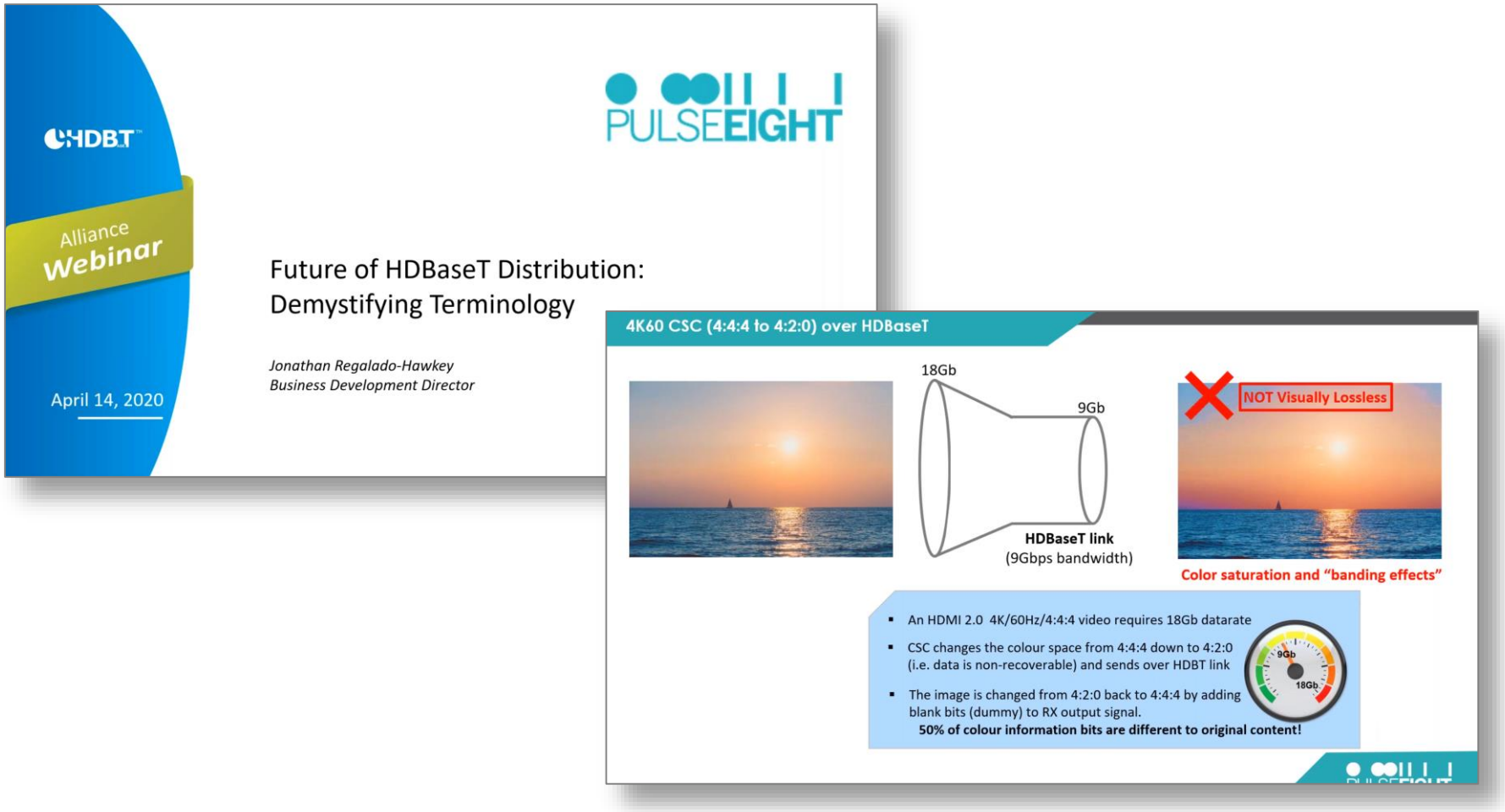
# The Bandwidth Challenge

## What about Color Space Conversion (CSC)?

- Not codec-based compression
- Reduces color. A lot.
  - Chroma subsampling to 4:2:0 (if it isn't already)
  - **Down-samples from 10-/12-bit to 8-bit**
- Fine for distributed systems
- Avoid for primary displays, especially HDR

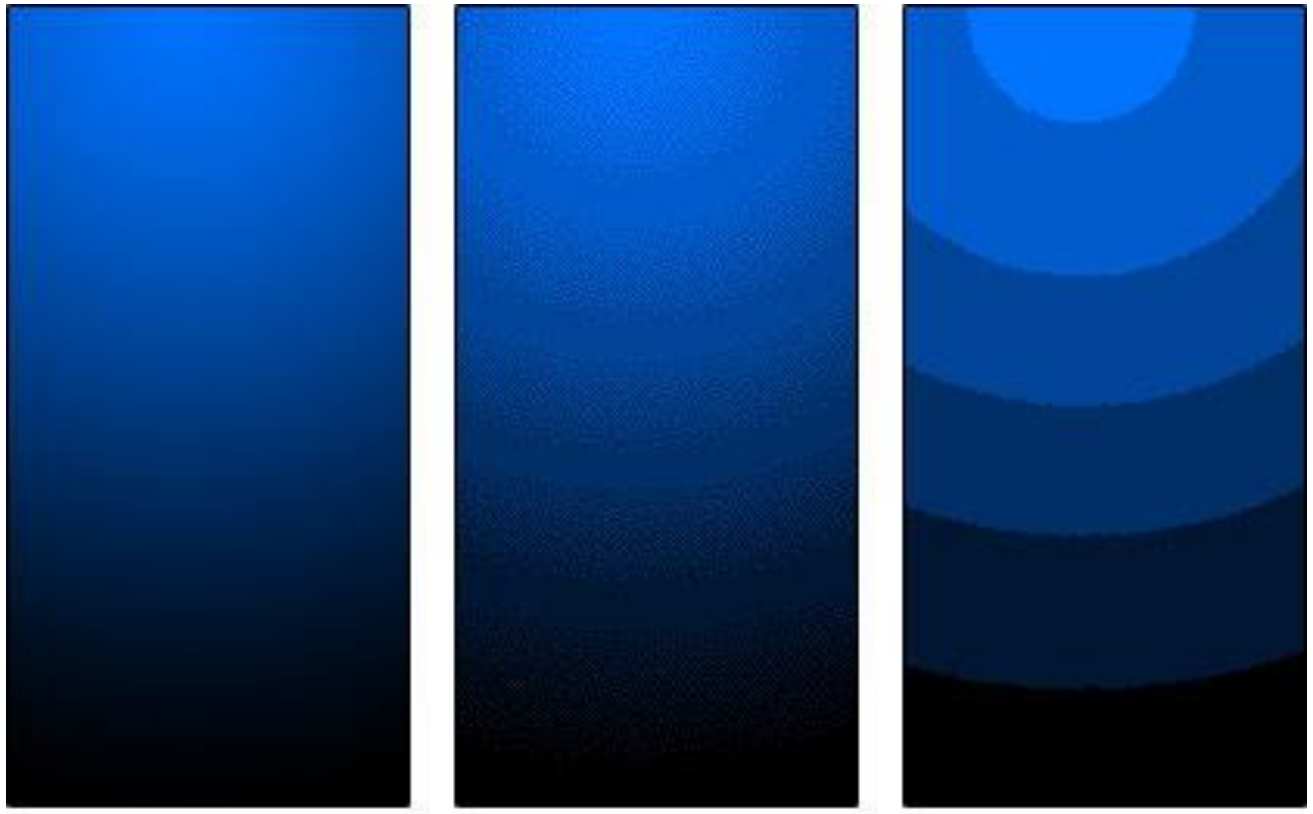
# The Bandwidth Challenge

## What about Color Space Conversion (CSC)?



# The Bandwidth Challenge

## 8-bit dithering



12-bit /subpixel | 8-bit dithered | 8-bit no dithering

# The Bandwidth Challenge

## HDBaseT 3.0 – the uncompressed 4K60 HDR solution

| Format | HDBaseT 1.0/2.0 | 1.0/2.0 with DSC | 1.0/2.0 with CSC | HDBaseT 3.0 |
|---|---|---|---|---|
| 1080p60 8-bit<br>(E.g., Blu-ray Disc) | Yes | N/A | N/A | Yes |
| 4K24 8-bit 4:2:0<br>(E.g., UHD Blu-ray, no HDR) | Yes | N/A | N/A | Yes |
| 4K24 10-bit 4:2:0<br>(E.g., UHD Blu-ray with HDR) | Yes | N/A | N/A | Yes |
| 4K30 10-bit HDR 4:4:4<br>(E.g., UHD Gaming) | No | Yes* | Yes* | Yes |
| "4K60 4:4:4"<br>Common moniker, but only 8-bit no HDR | Yes | N/A | N/A | Yes |
| 4K60 8-bit 4:2:0<br>(E.g., UHD Blu-ray) | No | Yes* | Yes* | Yes |
| 4K60 10-bit HDR 4:2:0<br>(E.g., UHD Gaming) | No | Yes* | No^ | Yes |
| 4K60 12-bit HDR 4:2:2<br>(E.g., UHD Gaming, limit of HDMI 2.0) | No | Yes* | No^ | Yes |
| 4K60 Dolby Vision | No | Yes* | No | Yes |

# The Bandwidth Challenge

## Identify primary displays for direct connection

- Best quality
- Reliable interoperability

# The Bandwidth Challenge

## Bottom Line

- To achieve 18Gbps HDMI equivalent, use either:
  1. **HDBaseT with DSC**, or
  2. **HDBaseT 3.0** for uncompressed

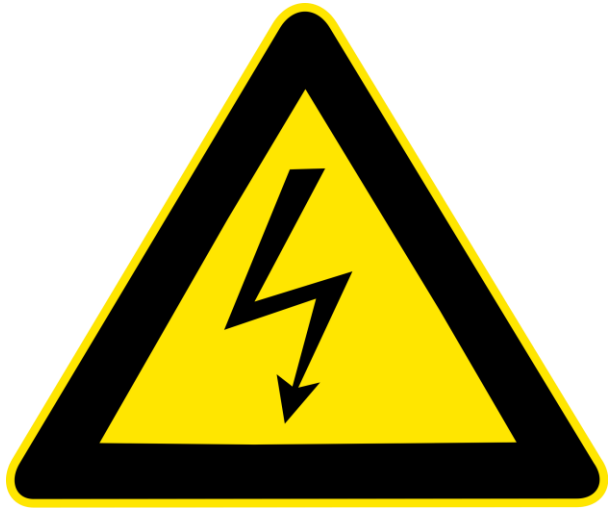
"Uncompressed is always best to ensure interoperability"

— *Gabi Shriki, Valens*

# S4: Power over HDBaseT

## HDBaseT ratified by IEEE

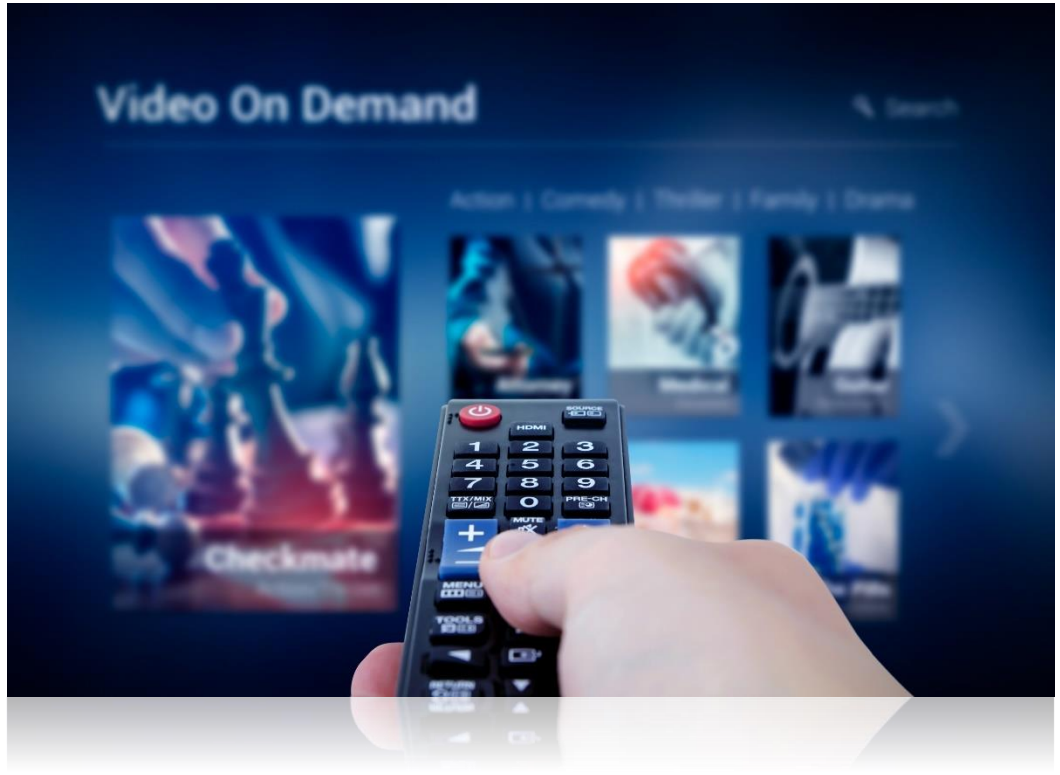
- Compliant PoH / PoE
  - IEEE 1911
- “Power-over-cable” (PoC)
- Importance of the cable
  - IEEE 802.3bt Type 3 (60W)
  - Type 4 (100W)



# S5: Point-to Point vs Distributed

## What is being distributed, and where?

- Streaming “cord cutters” on the increase
- Link from media box to display needs to be BIT EXACT



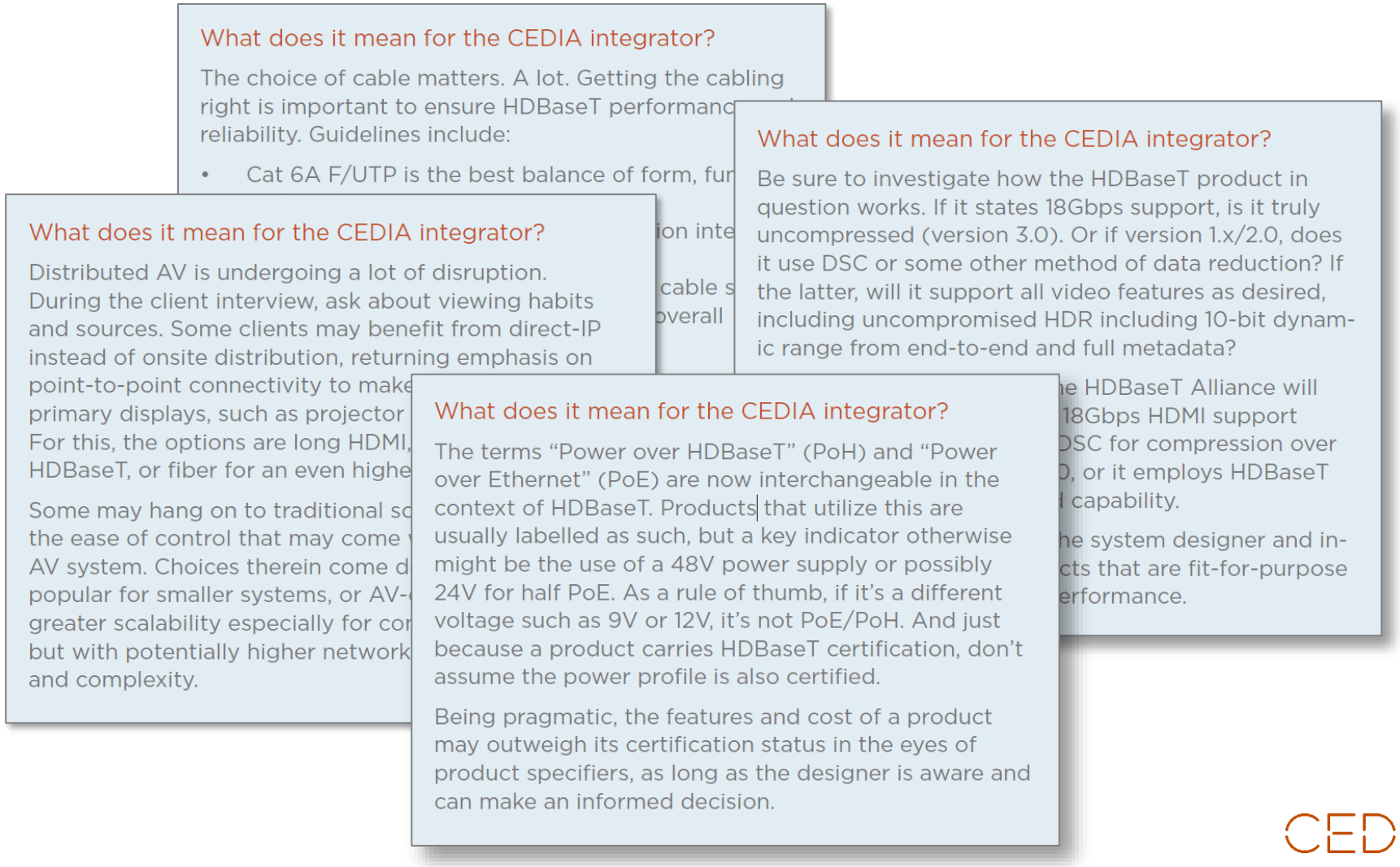
# S6: Cabling & System Design

## Cable type and termination

- Need for Cat 6A
  - TIA-570-D Residential Infrastructure
  - F/UTP recommended
- Termination of shield
  - To 1x floating end only
  - To all chassis + PoH ends

# Written for Integrators

## What does it mean…?



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Thank you for participating

## Questions?

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