

# Graceful Evolution to Beyond HD

**HPA Tech Retreat – 2017**  
**Geoffrey Tully**



# PLEASE NOTE

This presentation deck will be revised before Friday morning (to fix some errors and to add some additional information and resource links).

Please check back on the HPA “Presentations” link to download the updated version (that version will not include this message).

OR ... please feel free to email or call me:

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# Last year ...

- How many here attended the 2016 Tech Retreat Supersession?
- During the “What just happened?” Jerry & Leon asked
  - “How many people think 4K is significant?”
  - “How many feel that HDR is also important?”
  - “How many feel that 4K and HDR must be implemented together?”



# My Proposal

“I would like to speak to our graceful evolution into enhanced HD content (the various of HDR, HFR, and extended color) to the recently proposed and complimentary addition of higher resolution in consumer displays. ... the fact that the technology sector and the creative community have managed to bring forth an ecosystem that delivers such a compelling and unambiguous value to the consumer is something we can all, I believe, be proud of. Also, the fact that the high value content is now widely available over the full range of delivery systems (broadcast, cable, OTT ... ) is enabling the TV and other display device manufacturers to further enhance the consumer experience by adding 4K (and maybe higher) resolution to the system. !! Amazing. And fortuitous. It is a rare time in our industry when things fall together so smoothly to create new value and greater business opportunities ...”

“I wrote this from one of the parallel universes (may DC, maybe Marvel) where the cart of delivery improvement was drawn effortlessly by the horse of compelling content. It’s the Ultra HD history that we could have had ...”



# Which really came first?

- Displays with 4K resolution
  - Rec 709 and 8-bit color
- Then good upscaling (to accommodate HD inputs)
- Direct to Display 4K content delivery (streaming)
  - (enhanced features from external sources waited for HDMI)

# Conspicuous Absence

- Traditional television content delivery via broadcast and cable (4K was not an option within their infrastructure)
- Yet: the “added features” of HDR and HFR have a clear value in many types of broadcast content (notably sports).



# Enter UHD Blu-ray

- With the development of UHD Blu-ray (and a necessary HDMI update), 4K from external sources became available.
- Some theatrical content and some episodic television has 4K sources; hence the UHD Blu-ray has begun to feed the ecosystem.
- **However**, even in theatrical release form, very many movies are finished and distributed in 2K. To create Blu-ray versions, the video is upscaled before encoding and authoring.



# Step back 4 paces

- A reminder about 4K: You have to sit closer to the display than “normal” in order to see the improved resolution.
- No need to revisit the technical details ... we are all familiar with the analysis.
- My thanks to Merrill Weiss for this illustration (and a fun back-story):



# “New HDTVs are so good, you can't even tell”

In an NBC News story, former RCA VP, Bernard J. Lechner explains his eponymous 'Lechner Distance' and why it's important to know this number before being sold on the promise of more pixels. This was from December 2013 and related to HD, but the math transfers to UHD as well.

- <http://www.nbcnews.com/watch/nbcnews-com/new-hdtvs-are-so-good-you-cant-even-tell-81582147851>





# NINE FEET:

The distance most Americans sit from their television





# LECHNER'S NUMBERS



Screen Size: 65in.

Viewing Distance: 9 FT

Visible Resolution: 1080p



2:08 / 3:16





Unless you're sitting much closer than  
**9 feet** from your television, you won't  
see the benefits of a **65-inch 4K TV**.



2:27 / 3:16



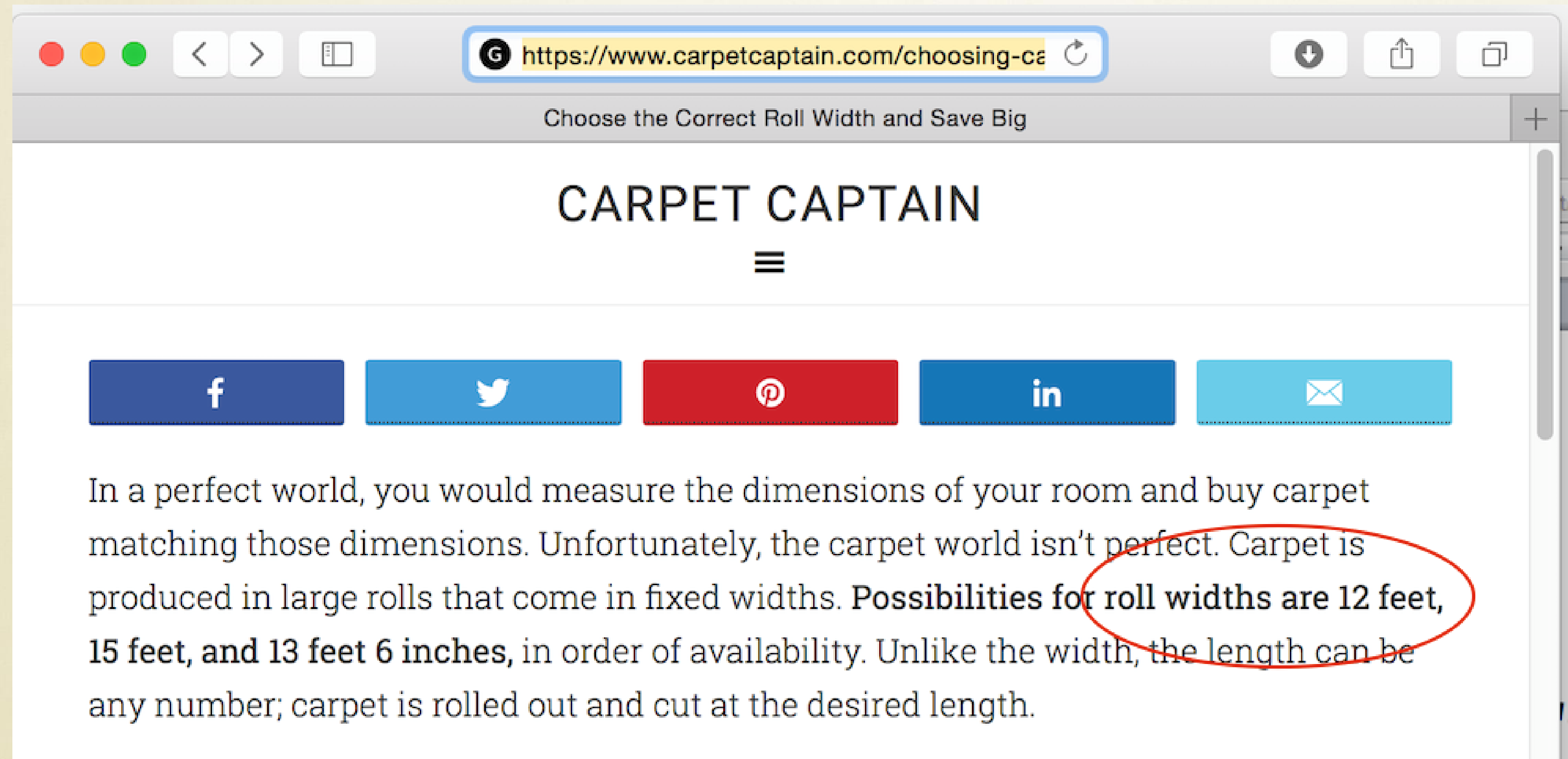


# Why do most of us sit 9' from the screen?

- Lechner measured distances in American homes.
- Typical living rooms were 12 feet deep; allowing for the depth of the sofa and the depth of a CRT TV, you're left with 9 feet of space.
- (We might wonder if flat screens may be widening the gap?)
- Why are so many living rooms 12 feet deep?



# Carpets are 12' wide



<https://www.carpetcaptain.com/choosing-carpet-roll-size/>



# My own UHD perspective



CEA Presents:  
**CE WEEK**  
June 24-28, 2013 • New York City



June 27, 2013  
11:30 a.m.- 5:30 p.m.  
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- Developing since I chaired a series of UHD conferences during the summer CE Week (2013, 2014, 2015).



**Your Next TV**  
**CONFERENCE**  
6.24.14 ■ Metropolitan Pavilion 125 W 18<sup>th</sup> St.



*From the Lens to the Living Room:*

**Your Next TV**  
**CONFERENCE**  
6.23.15 ■ Metropolitan Pavillon 125 W 18<sup>th</sup> St.

*How UHD/4K and Other TV Innovations  
are Changing the Home Viewing Experience*



- Speakers included Joe Kane, Mark Schubin, Bill Miller, Pete Lude, Larry Thorpe, and many other HPA and SMPTE members.
- An almost constant and very consistent story line was: We don't need **more** pixels, we need faster and **smarter** pixels.
- Yet every year, we hear the call to arms to produce more 4K content. Displays are 4K; we must feed them with 4K. Consumers demand it.



# 4K everywhere?

- In capture and production: I would say definitely.
- 4K displays: Absolutely!
- 4K delivery? I respectfully suggest that this is not required.
- It a number of instances, it is simply expensive and wasteful.
- In other cases, it is (or has been) impossible.



# How best to compress 4K?

- Another insight from Merrill Weiss:
- “Encode the content in Full HD.”
- Full HD content (when expertly produced using modern oversampling cameras) contains information that is not visible when viewed on an HD display. Put the same content on a 4K display that applies oversampling during up-conversion and you experience the full value in the content.
- Extrapolate to this: 4K source encoded properly into HD then upscaled in the display is likewise going to exhibit most of its high quality.



# HD-HDR is viable

- HDR is resolution agnostic. “4K-HDR” (as if they are married) is not essential to deliver the impact of HDR.
- HDR is not subject to the Lechner Distance.
- HDR implementations (HDR-10, DolbyVision, Technicolor/Philips) are fully compatible with HD as well as with 4K.



# HD-HDR is valuable

- Since it requires fewer bits, HD-HDR can open additional channels of distribution for HDR content.
- More HDR content means greater consumer choice (Nielson tells us this is a desirable thing).
- More HDR content accessible to consumers drive up the value of their investment in HDR-capable displays (i.e., UHD displays, which also happen to be 4K displays)



# what is stopping HD-HDR?

- “Everybody knows that Ultra HD HDR is 4K.”
- “No one is going to make HD displays that support HDR.”
- “Our marketing people say that we have to give consumers what they are demanding, and they are demanding 4K.”



# “We can’t market HD-HDR”

- Play video:

- Tom Campbell

Video and Audio Center (corporate director)

CTA Hall of Fame in 2015



# Branding considerations





# Ultra HD Alliance

- The UHDA specs only allow for 3840x2160 resolution.
- “The UHDA’s ULTRA HD PREMIUM logo is reserved for products and services that comply with performance metrics for resolution, high dynamic range (HDR), peak luminance, black levels and wide color gamut among others. The specifications also make recommendations for immersive audio and other features. These advances in resolution, contrast, brightness, color and audio will enable certified displays and content to replicate the richness of life’s sights and sounds and allow in-home viewers to more fully and accurately experience the content creator’s vision.”
- <http://www.businesswire.com/news/home/20160104006605/en/Ultra-HD-Alliance-Defines-Premium-Home-Entertainment-Experience>



# Ultra HD Forum

## key parameters for UHD Phase A

- Spatial Resolution **1080p\*** or **2160p**
  - \*1080p together with WCG and HDR fulfills certain use cases and is therefore considered to be an Ultra HD format.
  - 1080p without WCG or HDR is considered an HD format.
  - 1080i or 720p plus HDR and WCG are not considered.
- UHD Forum does not support a logo-branding for products.
- <http://ultrahdforum.org/resources/phasea-guidelines-description/>



# Blu-ray Disc

- BD-ROM Part3 V3.1 White Paper: Provides technical specifications and features of the Ultra HD Blu-ray format.
- Allowed combinations of resolution, transfer characteristics and bit-depth for HDMV HEVC video streams include HD-HDR.
- Thus, a disc that uses this approach can be branded with the Ultra HD Blu-ray logo. HDR branding is not specified.
- [http://www.blu-raydisc.com/Assets/Downloadablefile/BD-ROM\\_Part3\\_V3.1\\_WhitePaper\\_160729\\_clean.pdf](http://www.blu-raydisc.com/Assets/Downloadablefile/BD-ROM_Part3_V3.1_WhitePaper_160729_clean.pdf)

# Seriously, HD-HDR on Blu-ray?

- Well, why not?
- The most Ultra of the Ultra HD features is HDR.
- Even at UHD Blu-ray data rates, current encoding tools may leave artifacts that HD (at the same very high data rates) would not exhibit.
- Since many of the sources for UHD BD titles are 2K, why add the expense of up-conversion to the budget?



# ATSC 3.0 has solved it

- It provides for 4K payloads, including HDR and the other Ultra enhanced features.
- Yes. And this has been shown already in trials.
- But, for those who missed Monday's ATSC 3.0 Seminar, the broadcasters present all agreed that while HDR is a near-term objective, 4K is not going to come soon.

# OK ... but IP HDR is 4K

- Today there are 4K HDR titles available on streaming services.
- 4K payloads are still bigger than HD; and in this case, bigger means “needs more resources from the network,” and at some point that is going to cost someone more money. Infrastructure is not free.



# IP has strengths, but

- At this past SMPTE Conference, there were reports of consumer/technology/infrastructure evaluations
- Show heavy cost and performance penalties from trying to force 4K through the existing IP infrastructure .
- Results: only a small percentage of consumers who subscribe to ultra high bandwidth services actually spend any time getting the top layers of their subscription UHD content feeds.
- ABR still buffers and s t u t t e r s; and is only sometimes actually 4K in the home.

# Now what?

- My goal for this presentation was to present some ideas and concepts that would stimulate thinking and interaction within this community.
- Please attend (and support?) the Broadcaster's Panel.
- Please visit the Innovation Zone:
  - Dolby & Grass Valley to see HD-HDR in action
  - Telestream & Blackmagic Design (HDR tools)
  - Teledyne LeCroy, Tektronix and SpectraCal (HDR testing & measurement)



# Talk among yourselves

- There are more experts here than almost anywhere else you could go.
- Each expert will have some opinion (possibly more) about some or all of what I have said. Some will disagree, and be able to prove where I am misguided.

# Questions?



# Stop Trying to Help: Making the Living Room Safe for Content

HPA Tech Retreat - 2015  
Chris Armbrust & Geoffrey Tully



# Maybe One More Thing

- There is likely to be high dynamic range in displays before there is much HDR content delivered to the home.



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- What if someone is developing the HDR equivalent of motion interpolation?



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- There is likely to be high dynamic range in displays before there is much HDR content delivered to the home.
- What if someone is developing the HDR equivalent of motion interpolation?
- TVs would be able to automatically show HDR images, even if the input programming is SDR.



2 years ago, “I told you so ...”

- At CES 2017, almost every manufacturer who showed HDR-capable displays also showed features that would produce HDR when presented with SDR content.
- If this is a good thing, why do we need to go to the expense of processing HDR into titles; let the TVs do it. (I do not think Steve Poster would favor this.)
- Maybe there should be some metadata to indicate creative intent from the content into the displays?



# Thank you

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