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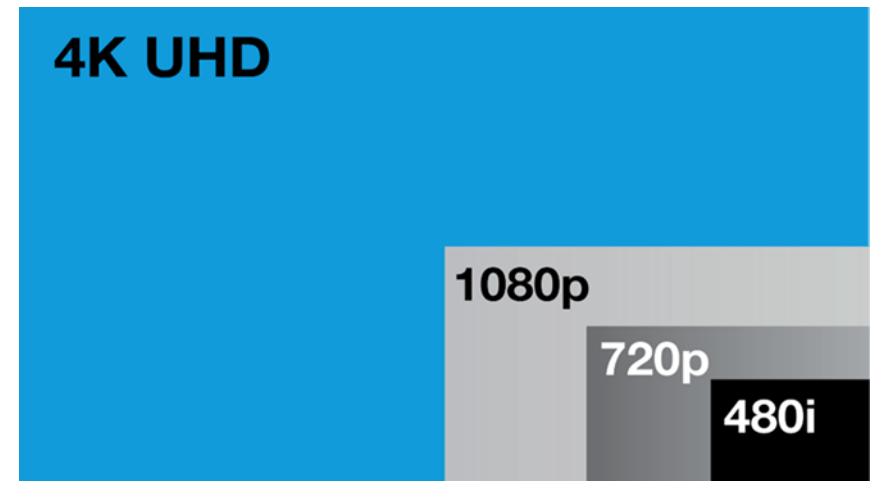
# Get Ready for 4K



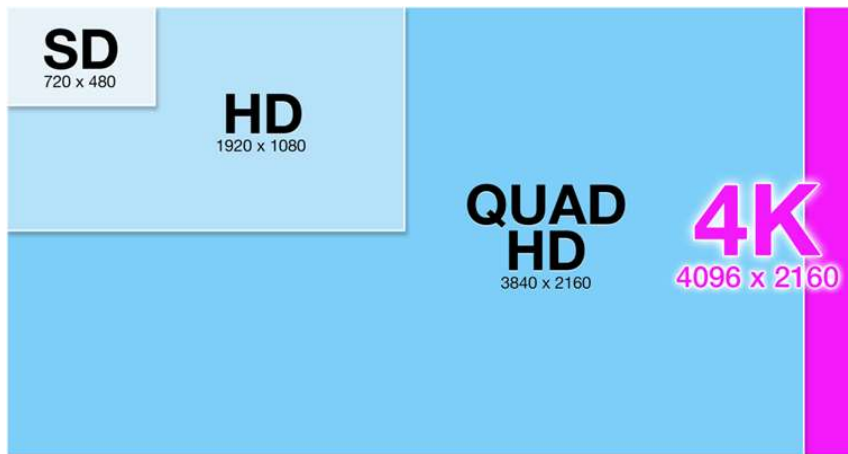
# What is 4K?

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- A new class of resolutions around 4,000 pixels wide
- Four times the resolution of 1080p
  - 8 megapixels of video
  - Double the horizontal resolution
  - Double the vertical resolution



# What is 4K?



- Two resolutions
- “Quad HD”
  - 3840 x 2160
  - A.k.a. “Ultra HD”
  - Exactly 4x 1080p
  - 16:9
  - The most common flat panel format
- “True 4K”
  - 4096 x 2160
  - Approximately 17:9 (1.90:1)
  - Created for digital cinema

# Why the Demand for 4K?

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- Simple answer: the TV marketing machine
  - Look around you – 4k advertisements everywhere
  - The high street need new TVs to sell
- High end home theater system projectors
- Coming soon – very large touchscreens
  - 50” – 80” class screens
  - At arm’s length, even 1080p becomes pixilated

# Why the Demand for 4K?

- No doubt 4k is here to stay



# 4K Applications

- “Close up” applications
  - Laptops
  - Digital signage
  - Touch systems
  - Huddle rooms
- Large format displays



# 4K Applications

- Security and military
- Emergency operations
- Mapping
- Medical (X-ray, CAT scans)
- Movie and TV content



# Does this make sense?

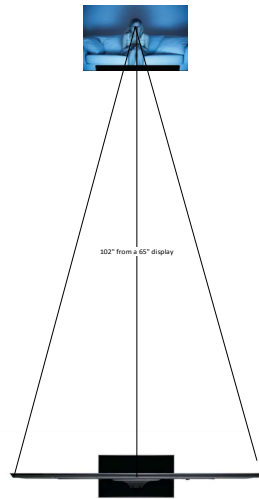
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$$VD = \frac{DS}{\sqrt{\left(\frac{NHR}{NVR}\right)^2 + 1} \cdot CVR \cdot \tan \frac{1}{60}}$$

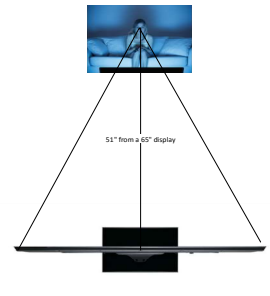
- Assuming human visual acuity of 1 arc minute
- VD: Viewing distance
- DS: Display's diagonal size
- NHR: Display's native horizontal resolution (in pixels)
- NVR: Display's native vertical resolution (in pixels)
- CVR: Vertical resolution of the video being displayed (in pixels)

# Does this make sense?

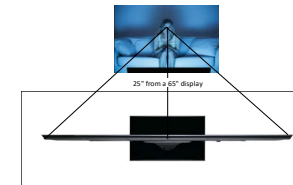
- Resulting viewing distances for a 65" Display



1080p: 2.5m



4K: 1.3m



8k: .6m

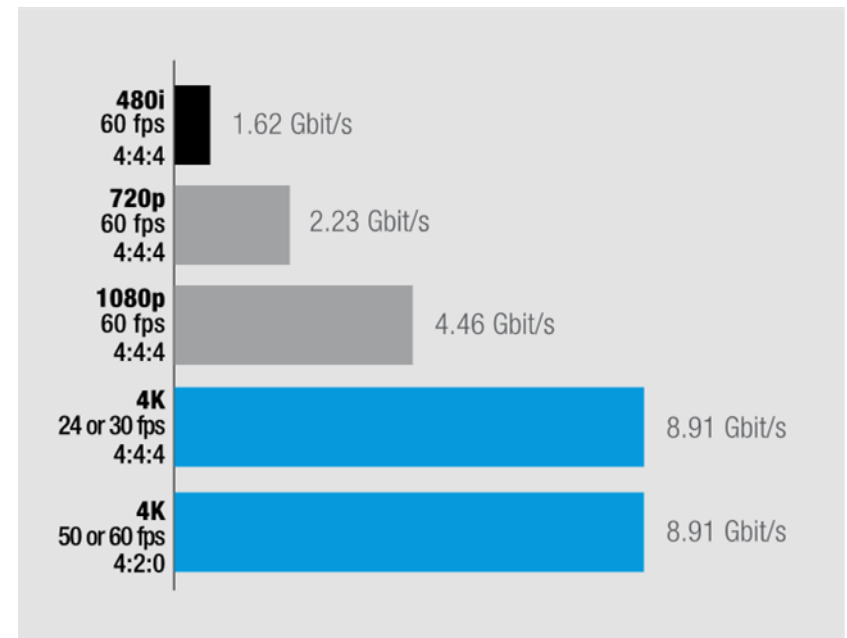
# Think You Don't Need 4K?

- 1080p switchers can't handle the latest high-resolution devices
- Surface Pro 3: 2140x1440
- 13" MacBook Pro<sup>®</sup> with Retina: 2560x1600
- 15" MacBook Pro with Retina<sup>®</sup>: 2880x1800
- Dell<sup>®</sup> XPS<sup>®</sup> 15 and Precision<sup>®</sup> M3800: 3200x1800
- LG<sup>®</sup> G3<sup>®</sup> phone: 2560x1440



# More pixels → more data

- 4k requires at least double the data rate of 1080p
- This will have consequences on infrastructure



# 4K Bandwidth and Limitations

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- 4K = 4 x 1080p
- HDMI 2 or 4K/60 4:4:4 is 18 Gbps, and that is available today in some products.
  - HDMI not useful for video distribution
  - Maximum distance of 10m
  - Not field terminate-able
- Transport technology distances
  - HDBaseT® – 9 Gbps (100m)
  - Fiber – 9 Gbps (330m)
  - Ethernet – 10 Gbps (100m copper, longer for fiber)



# 4K Bandwidths and Limitations

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- How do you fit 18 Gbps into a 10 Gbps pipe?
  - Cut the framerate
  - Chroma Subsample



# 4K Bandwidth Solutions – Cut Framerate

- Cut the framerate in half
  - 4K/30 4:4:4 – 9 Gbps
    - Computers use this approach
    - Good for most presentations
    - If content is not fast-moving, there's no noticeable degradation of video quality



## 4K Bandwidth Solutions – Cut Framerate

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- Tweener laptops and below are 60 fps
- Cutting to 30 fps is a step backwards if any motion content
  - 1080p/60 video through a 4K/30 scalers becomes 1080p/30



# 4K Bandwidth Solutions – Chroma Subsample

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- Chroma sub-sample
  - 4K/60 4:2:0 – 9 Gbps
    - 60 fps preserves the integrity of the fast-motion content
    - Blu-ray®, cable/satellite boxes, and streaming sources are encoded in 4:2:0, so the source will simply pass that on through the HDMI cable



# Chroma Subsampling

- Introduced by HDMI® 2.0 specification
- Compression technique takes advantage of fact that the human eye is much more sensitive to light than colour
- Colour (chroma) data is shared across multiple pixels, while each pixel gets its own light (luma) level
- Blu-ray® Disc Association adopted this to fit high-resolution content onto discs; broadcasters, also, to save bandwidth



<http://hdguru.com/ultra-hd-blu-ray-is-on-the-way-2/>

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# HDBaseT

# HDBaseT

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- HDBaseT carries all signals over category cable
  - Uncompressed video, audio
  - Ethernet, control
  - Power
- The alliance offers a compatibility certification program



# HDBaseT

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- HDBaseT Class A carries all features of 5play
  - Ethernet, video, audio, AV control (CEC etc.), USB & Power
- HDBaseT Class B carries some features of 5play
  - video, audio, AV control (CEC etc.), USB & Power



# 4K and Scaling

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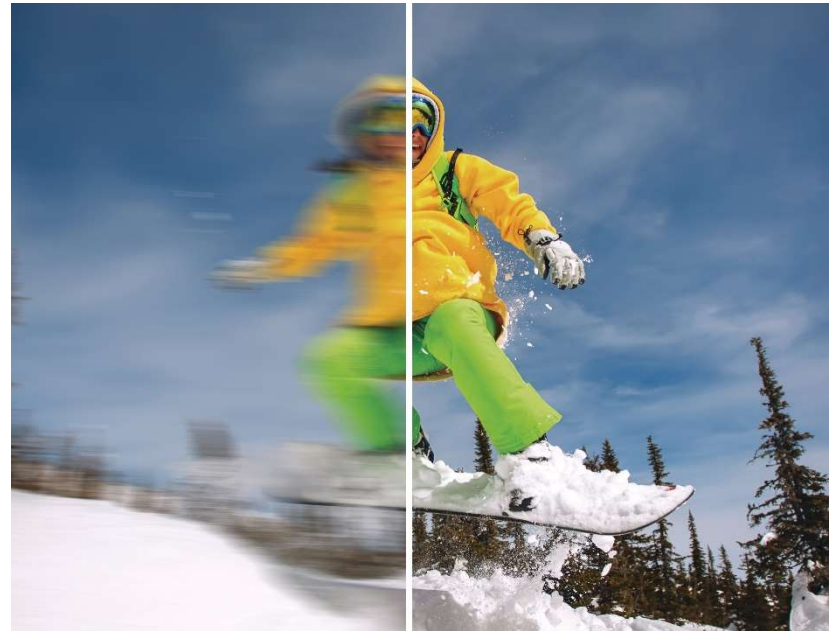
- Up and down scaling is required
  - Many scalers only scale up to 4K/30
- Resolution compatibility
  - 4K DCI content to 4K UHD displays
  - Upscaling 2K (1080p) sources, codecs, streaming encoders, and legacy analog devices
  - Downscaling high resolution laptops (e.g. 2560x1440)



# 4K and Scaling

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- Frame rate compatibility
  - Scalers must convert across 24, 25, 30, 50, and 60 fps for all resolutions
  - Many scalars only support 4K/30; video looks choppy, as a result
- Fast switching
  - Many displays have internal upscalers, but not optimized for speed
    - Internal scalars optimized only for inputs on the display rather than an external device



# Updated Content Protection – HDCP 2.2

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- No image displayed if every device in signal path doesn't support HDCP 2.2
- Hollywood studios elected to require HDCP 2.2
- All consumer 4K sources will support HDCP 2.2
  - 4K Blu-ray players
  - Cable and satellite set-top boxes
  - Network streaming devices
  - Laptops expected to follow soon to support streaming services and Blu-ray Discs



# Updated Content Protection – HDCP 2.2

- Source dictates level of content protection (e.g. HDCP 2.2)
  - Every active video device inline must also support HDCP 2.2
    - Switchers, HDBaseT transmitters and receivers, AVRs
  - Passive devices (e.g. cables and couplers) do not need to support HDCP 2.2



## Slide 24

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**DJ5**

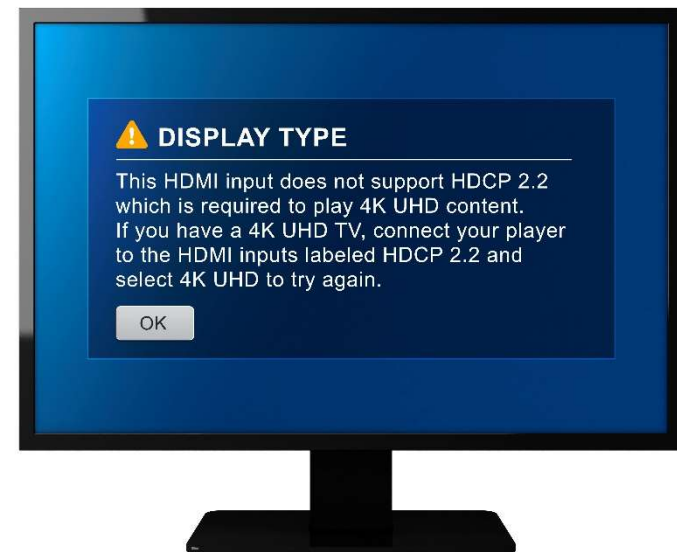
Should show the signal path from source to TX, to switcher to RX to display, each must support HDCP 2.2

Daniel Jackson, 25/05/2016

# Updated Content Protection – HDCP 2.2

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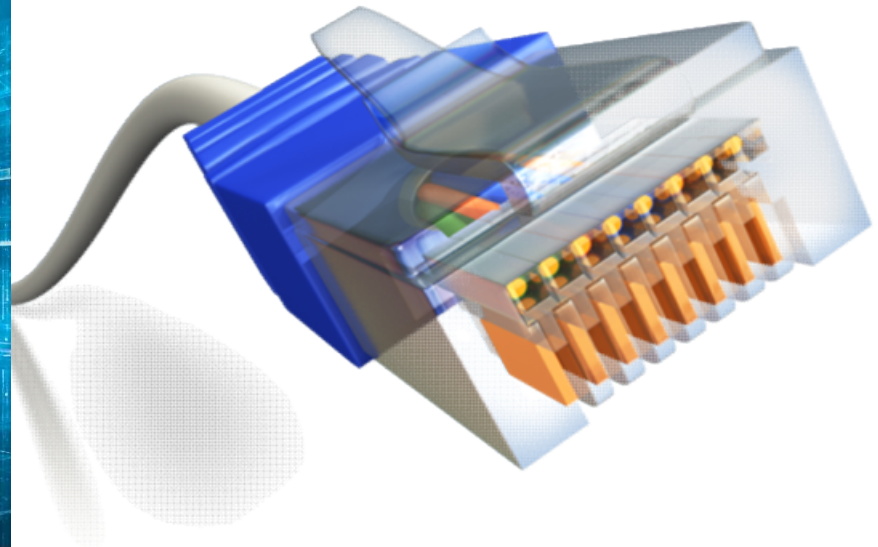
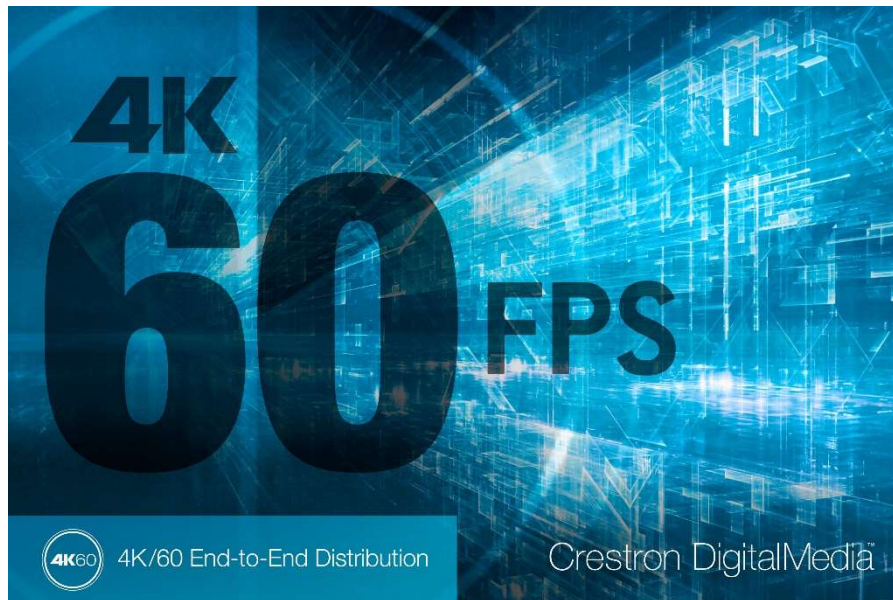
- Hardware upgrade required; no firmware fix or upgrade
  - Based on Internet-standard encryption algorithms
    - HDCP 1.4 was based on weaker non-standard encryption mechanism
- Not all 4K devices support HDCP 2.2



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# Streaming

# 4K and Streaming



# Streaming 4k

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- Very high bandwidth
  - Uses 8.9 Gbit/s for uncompressed video
  - Industry standard is H.264 currently
- What's the Catch?
  - Reduced quality
  - Delay, delay and delay.

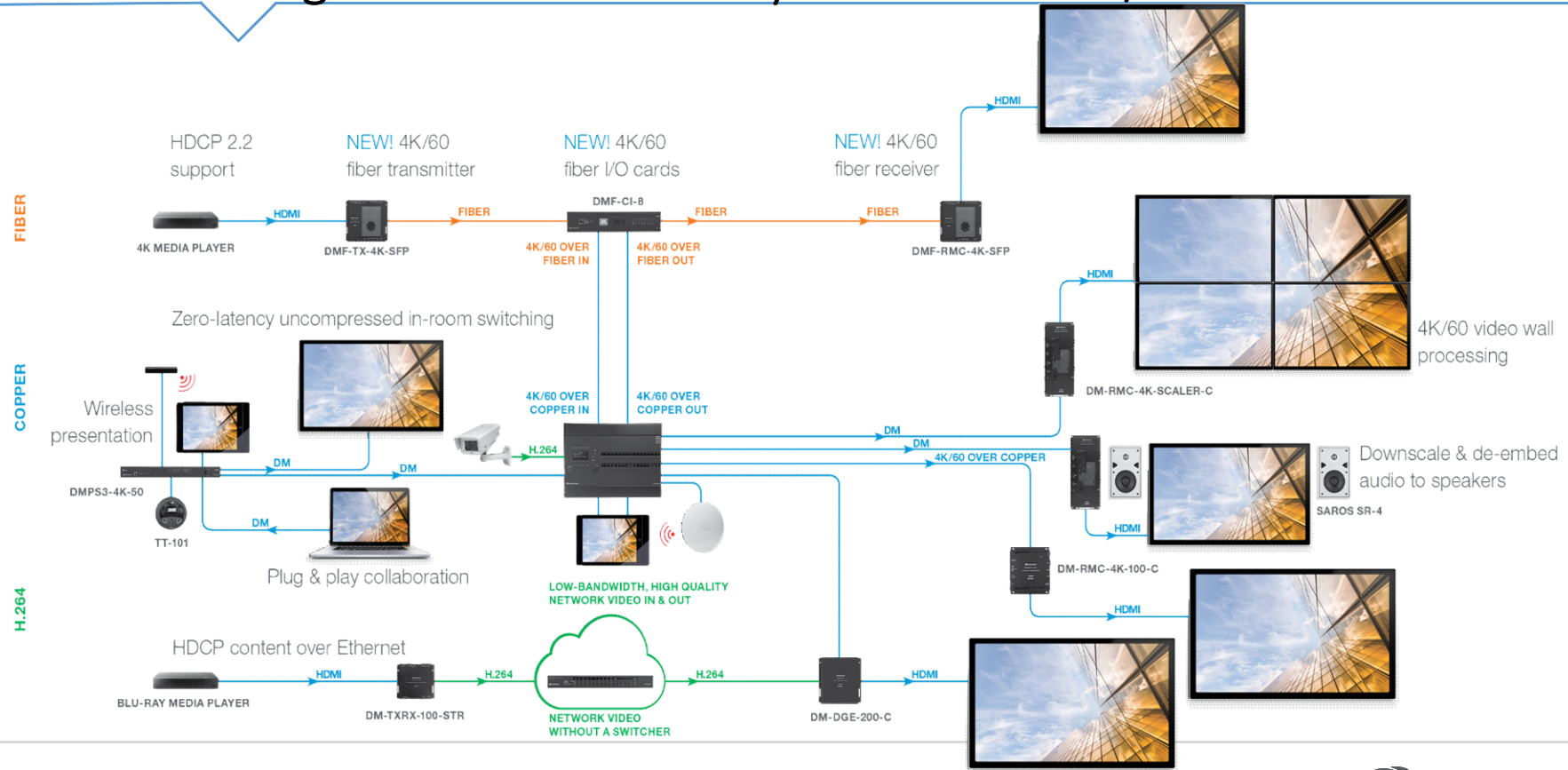


## Crestron DigitalMedia – The Only End-to-End 4K/60 solution

- 4K/60 copper transmitters
- 4K/60 copper inputs on presentation systems and matrix switchers
- 4K/60 copper outputs on presentation systems and matrix switchers
- 4K/60 copper receivers
- 4K/60 scalers (up & down)
- HDCP 2.2 support for all 4K products



# Crestron DigitalMedia – The Only End-to-End 4K/60 solution



## 4k: Conclusions

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- System designers and integrators must carefully consider the systems they are assembling to provide a good end user experience.
- Before you select an HDMI distribution system, it's essential to fully understand the capabilities of the solution and identify limitations.
- It's now more critical than ever that system designers use components they can rely upon.
- Combining low-cost extenders and other uncertified peripherals will compromise the integrity of a system.
- Furthermore, most 4K switchers cannot provide downscaling of 4K content for non-4K displays or down mixing of multichannel audio for stereo zones.

# Thank You For Listening

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