Dolby Vision

Production, Delivery and Display

July 31, 2018

Dolby Participation in the Industry

- "Dolby Vision" ecosystem has launched for services where standards are not required
  - Branded: content, delivery, display
  - OTT: Warner, Sony, MGM, Universal, Vudu, Netflix, Amazon; Vizio, LG, TCL
  - Cinema: Dolby Premium Cinemas

- Broadcast needs standards so Dolby is leading standards development
  - JPEG-HDR (**ISO/IEC 18477-2**) for richer still photography
  - SMPTE **ST 2084** (PQ), **ST 2086** (static metadata), **ST 2094-10** (dynamic metadata)
  - ITU-R Report **BT.2390**, ITU-R Recommendation **BT.2100**
  - MPEG-HEVC Development, Enable and Improve for HDR
  - ATSC A/341 Annex E
  - ETSI **TS 103 572**

Dolby Contributions to HDR

PQ

- Transfer function requires **no compromises**: can represent deepest blacks to brightest highlights, with detail visible (and **no** contouring) across the entire range from black to 10k nits (no need to limit highlights)

ICtCp

- The YCbCr limitations become apparent with HDR and WCG.
- ICtCp is a color representation with attributes of constant luminance and constant hue

Optional ST 2094-10 metadata to assist display adaption

- Allows receivers to optimize image display based on actual display capabilities
- Metadata can be generated live at encode

Distribution Partners

Content

200+ movies completed and approved

100’s of hours of episodic television

Multiple production facilities

Dolby and Standards

Dolby has been a leader in HDR standards development

- Chairs or leads Standards efforts in:
  - ITU-R
  - SMPTE
  - MPEG
  - ETSI
  - DVB

Display Adaptation

With the advent of HDR, mastering displays can and will be different than consumer displays

- Display Adaptation (aka Dynamic Metadata) adjusts content in the display device based on:
  - Target display (brights, darks and color volume)
  - Target viewing environment
  - Keeps the creative intent on the target display

Types of metadata

Descriptive Metadata

- Content is parameterized
- Unique solution is created for each display at the point of display based on:
  - Content
  - Display
  - Environment
  - Trims (creative)

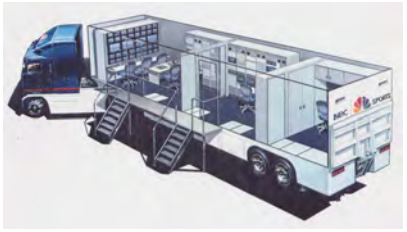
Prescriptive Metadata

- Curve(s) are created upstream
- Either many curves are transmitted or a small set
  - Many curves gives better interpolation but raises bit rate
  - Small set of curve(s) means most solutions are interpolated or extrapolated
  - Creative intent is limited

What is in Dolby Vision Metadata?

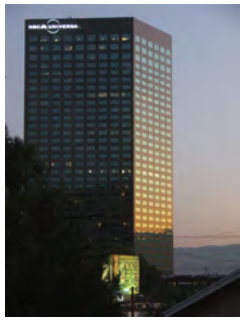
Metadata Level	SMPTE ST 2094-10	A/341 Annex E / TS 103 572
L0	N/A – see ST 2086	MDCV SEI (ST 2086)
L1	Min/mid/max luminance of scene	Min/mid/max luminance of scene
L2	Display Specific Trims (Creative)	Display Specific Trims (Creative)
L3	L1 offset – in SMPTE, HDMI; (Creative)	
L4	Not defined in 2094-10	
L5	Processing window	Active area (Letterbox)
Other Levels	Not defined in 2094-10	Structure is extensible

High Level Functional Diagram



Live

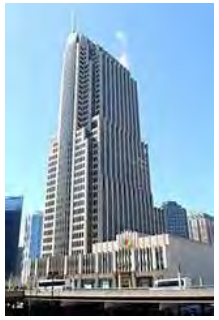
Cinema Trim



Studio

Graded

Graded



Broadcast Network

Mixed live, graded and local content

Local Station

Signaling is a mix of network, local and syndicated content. Metadata can be generated at emissions when missing.

OTA

MVPD

Internet Delivery

Offline Production

Cinema Grading

Cinema trims

Dolby Cinema (Laser)

Video Grading

4000 nit
2100

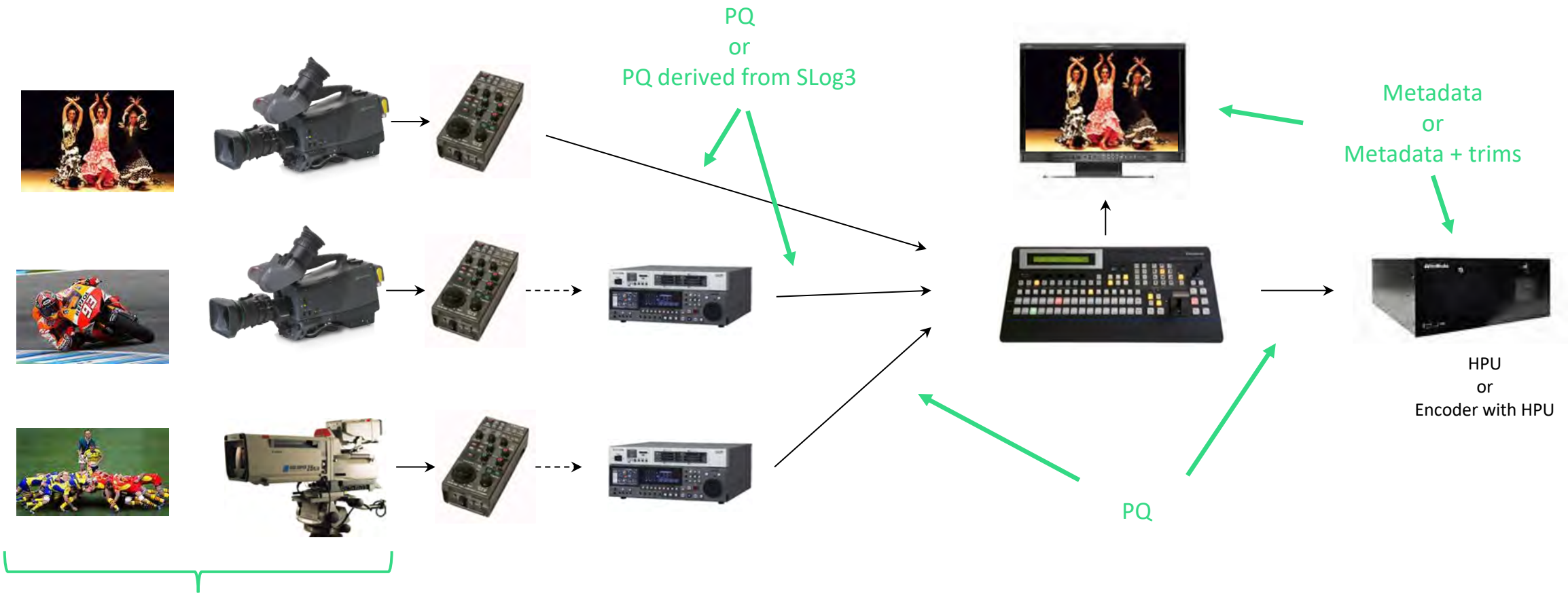
1000 nit
P3

100 nit
709

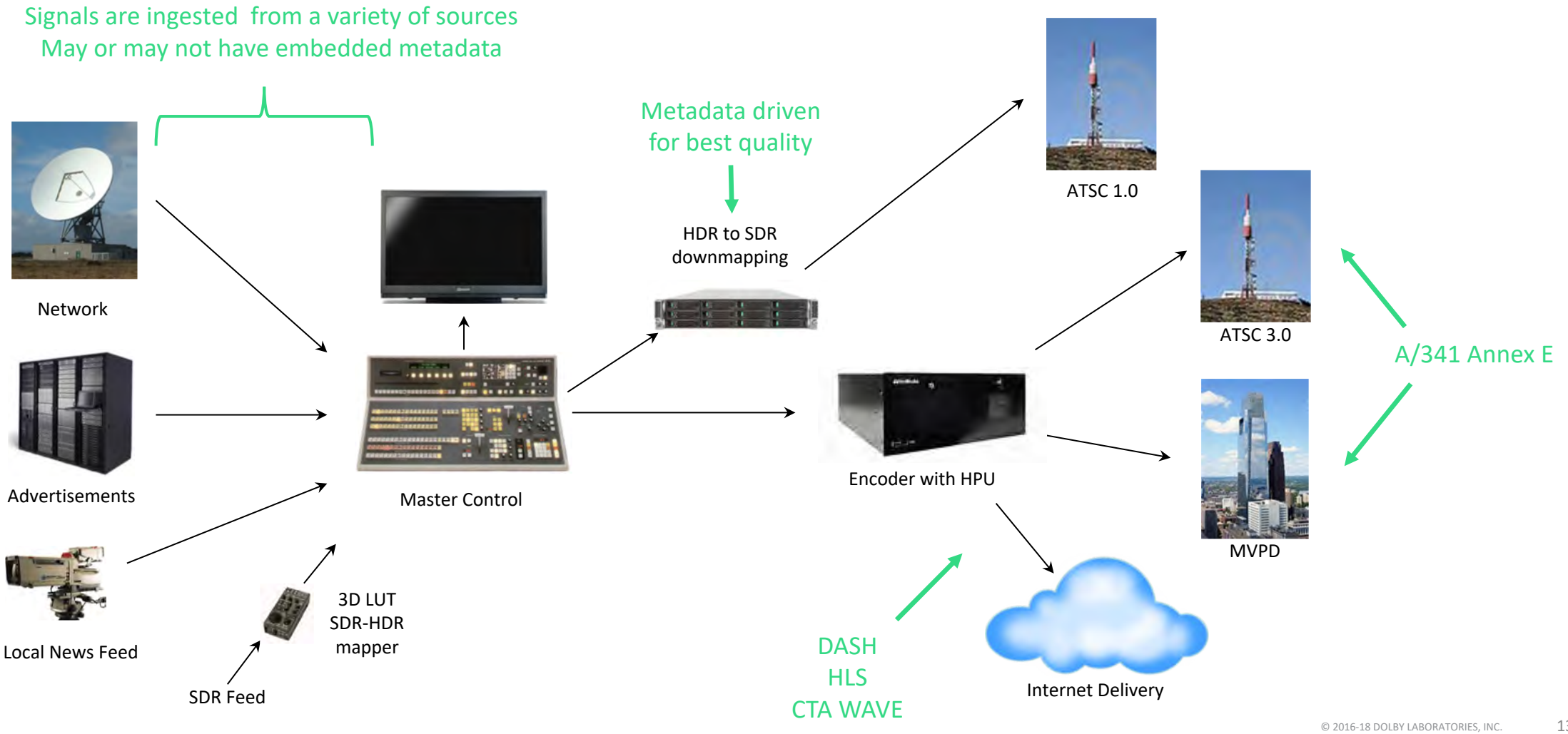
Descriptive metadata
with target trims

Video target

Live Production



Affiliate and/or O&O



MVPD

Advertisements

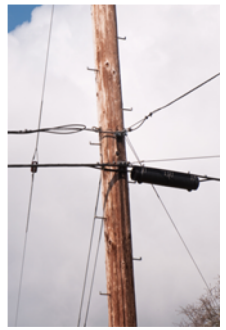
Network

ATSC 3.0

Compressed
or
Uncompressed

Streamed Content

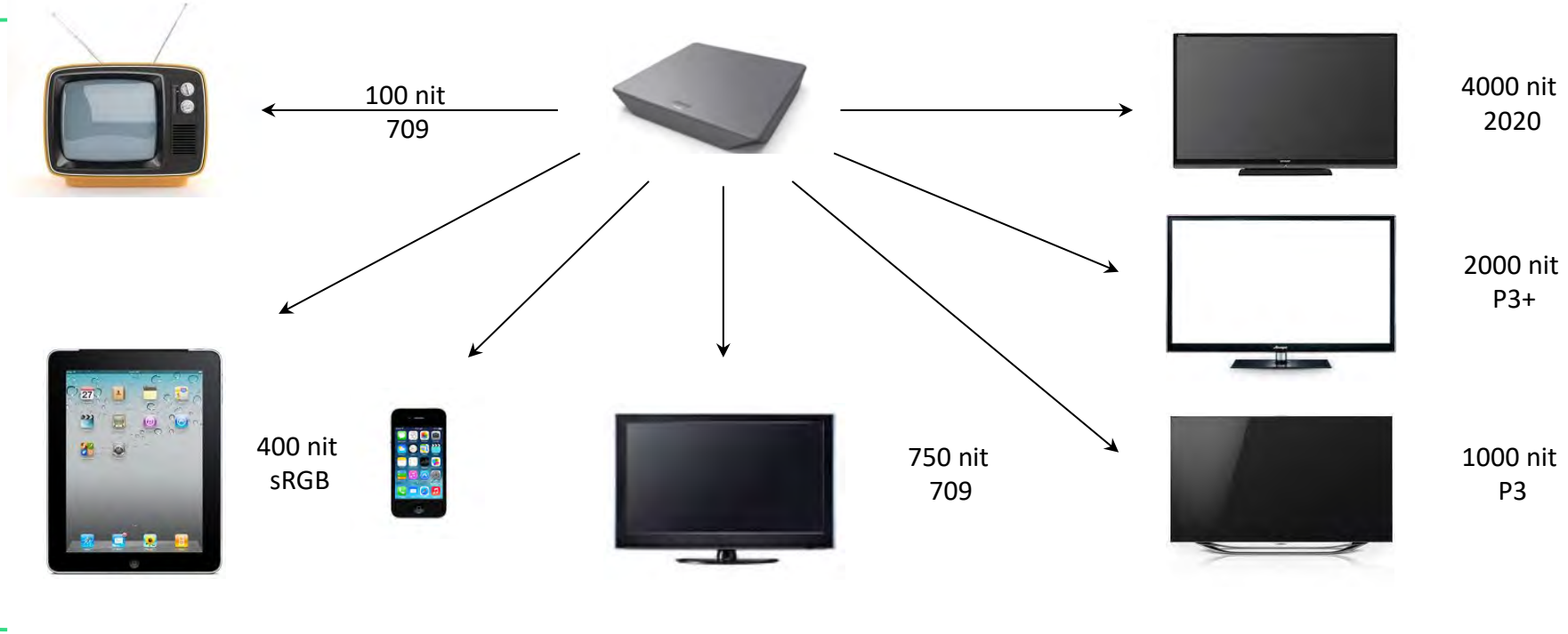
HPU integrated into the encode platform



If Display Metadata exists, pass it through;
Otherwise generate the metadata

Home Slide

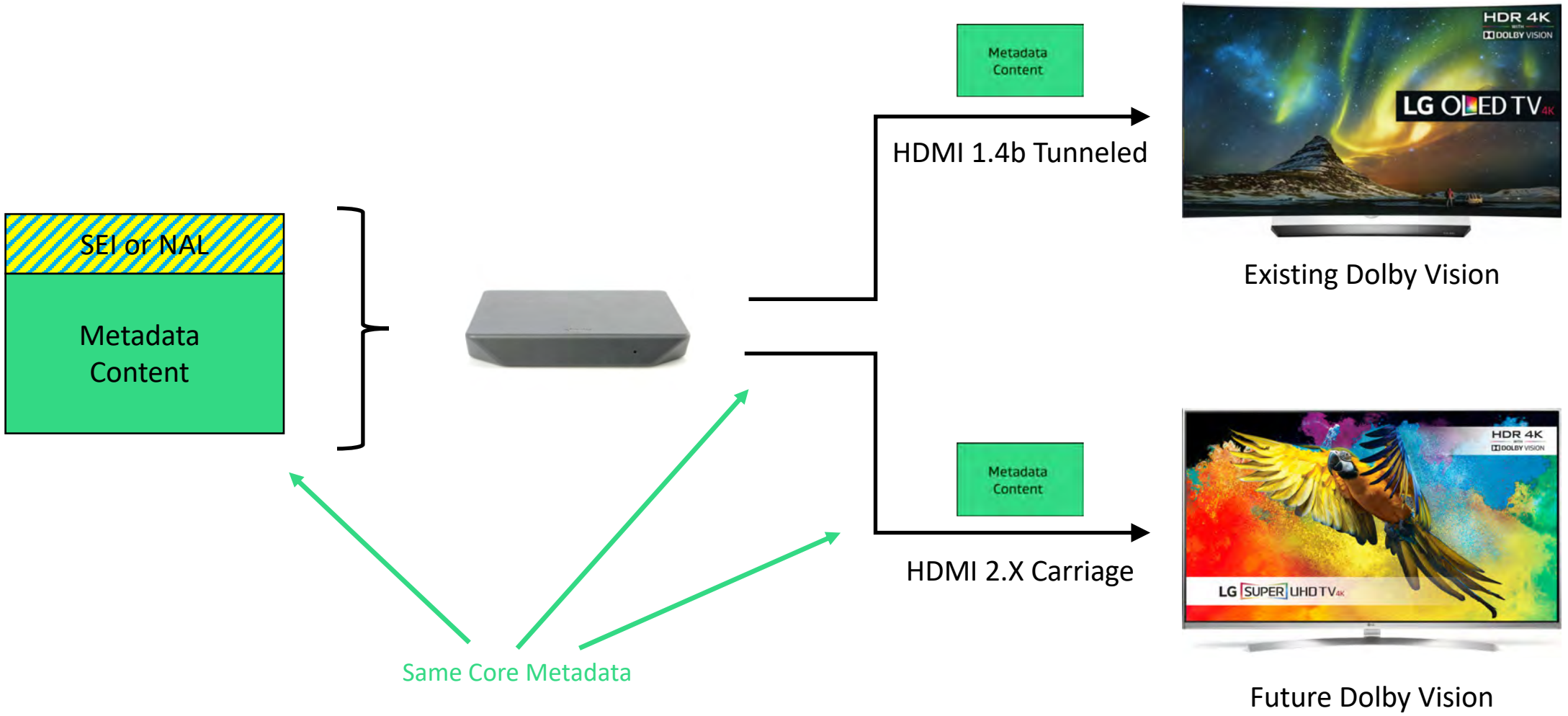
or



Curves are created at the display device

Content is optimized to the display at the point of rendering

HDMI Carriage of Dolby Vision Metadata



ATSC 3.0 Over-The-Air (OTA) Demonstration

WJW Transmitter Setup

Server with “Lowriders” (4000 nit) content

A/341 Annex E
Full Range

MP4 Packets
with
SEI Messages

Triveni

DASH/ROUTE
Packets

Enensys
Gates Air

600 KW ERP
2000 ft HAAT

WJW Receiver Setup

Received RF
with
ST 2094-10 SEI

Prototype LG ATSC 3.0 TV
without Dolby Vision in RF
path displays HDR10.

Received RF
with
ST 2094-10 SEI

Stream
with
SEI Message

PC modelling a STB

HDMI
with
Dolby Vision

Current model LG HDR TV
purchased locally at
Best Buy plays Dolby Vision.

SMPTE and ATSC Playback

PC modelling a STB

HDMI
with
Dolby Vision

Current model LG HDR TV plays Dolby Vision.

Captions, Graphics and Overlay Demonstration

Hisilicon STB

Overlays

Apple TV

Captions

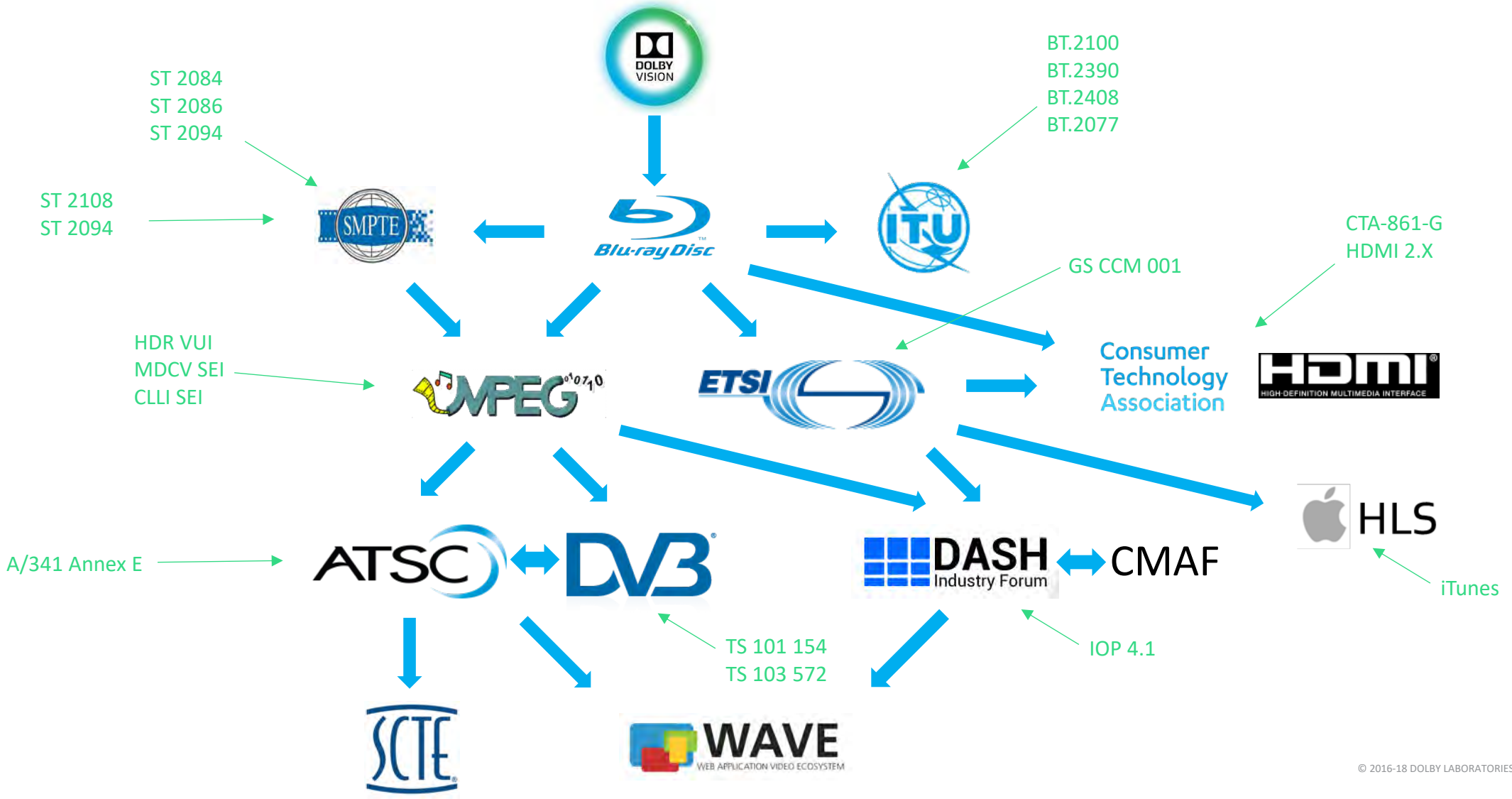
LG HDR Blu-ray

Overlays and Captions

HDMI 1.4b
and
HDMI 2.0

Current model LG HDR TV.

Standards Ecosystem



Key Points

Dolby is a pioneer and leader in HDR development

Descriptive metadata provides optimal display adaptation

Dolby Vision ecosystem exists and is being standardized

Dolby Vision has been publicly tested and demonstrated