# Ultra HD Forum Introduction

**15:00-15:30 - Welcome and Forum Update:** David Price, Ericsson, Ultra HD Forum

**History and Progress**

**UHD Alliance and other Liaisons**

**Adoption Guidelines**

**Interoperability Testing**

**Key Outstanding Challenges**

# Ultra HD Forum History

- Initially conceived in conversation with David Wood in 2012

- Realization that Ultra HD >>> 4K (WCG, EOTF, HFR etc.)

- Concern that 4K was already penetrating consumer market

- Huge potential for confusion and market

- Huge potential for market fragmentation

- Deep concerns about backward compatibility

- Deep concerns of potential format war and proprietary solutions

# Global Advocacy for Ultra HD

# Ultra HD Forum Charter

## VISION

Stimulate widespread consumer adoption of UHD and enhanced HD by enabling the availability of compelling content from many sources, including feature films, scripted, and live television content, and its distribution through all current and emerging avenues of delivery to consumers

## GOALS

- Facilitate the development, coordination, harmonization, and adoption of relevant standards and guidelines being developed in various media-related standard organizations and consortia
- Identify guidelines and inform the industry on best practices for the implementation of end-to-end systems for the generation, distribution, and rendering of next generation content
- Ensure handling the needs of real-time workflows with capture of live content for live and on-demand distribution through broadcast, multicast, and unicast deliveries
- Promote and organize Ultra HD media applications, deployments, and successes

## DELIVERY

- The Ultra HD Forum is primarily a Business-to-Business (B2B) organization, and is **not a Standards Development Organization (SDO)**
- Technology is inclusive of ultra high definition resolution, high dynamic range, wide color gamut, high frame rate, advanced audio; the use cases of live, real-time, episodic, on-demand, broadcast, streaming, download and physical media distribution and other related technologies
- Facilitating interoperability tests, plug-fests and trials to demonstrate the usability and comprehensiveness of Ultra HD and related media standards
- Creating a central repository for relevant Ultra HD and related media workflows as well as members products & solutions
- Organizing industry-wide promotion events
- Producing white papers and the organization of informational "Master Classes" at major industry events and the demonstration of end-to-end solutions and proof of concept systems with common content created through diverse workflows

# Ultra HD Forum Progress

| Topics | Status | Details |
|---|---|---|
| Incorporation | ✔ | May 2015 |
| Membership Expansion | ★■✳□✳■ ✳ | 45 and growing |
| MasterClasses | ✔ | Started at IBC 2015 |
| Guidelines | ✸☆ | Phase A @ NAB 2016 |
| Interop | ✸☆ | 1st round at ATSC, March 2016 |
| Liaisons | ✸☆ | Planned throughout 2016 |

# UHD Alliance + Ultra HD Forum

| Capture | Production | Playout | Encoding | Distribution | Decoding | Display |
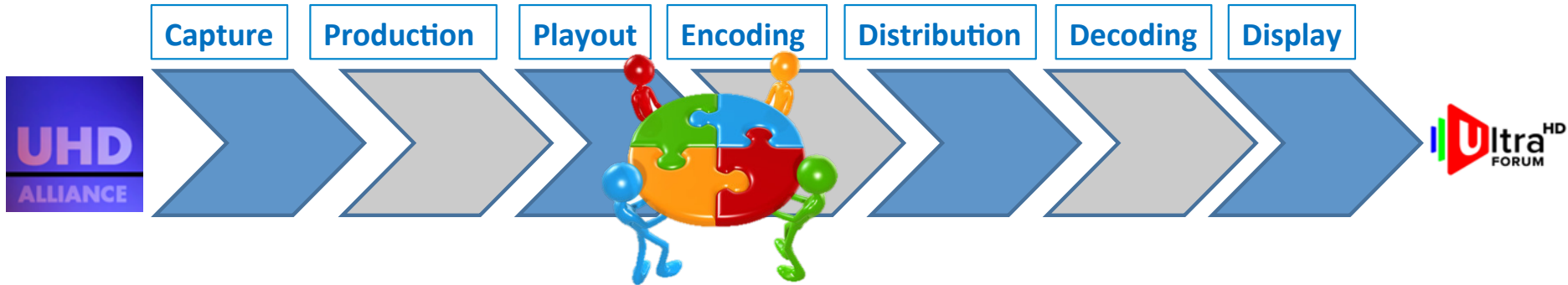
- Ultra HD Forum and UHD Alliance are complementary

- UHD Alliance is guaranteeing a consumer experience quality level through a logo program

- UHD Forum is focused on interoperability and best practices for the end to end ecosystem

# Recommendations

| Item | UHD ALLIANCE | Ultra HD FORUM |
|------|------|------|
| Publication | CES'16 | NAB'16 |
| Application | VoD / OTT | Live / Broadcast |
| Deployment | 2016 | 2016 |
| Codec | HEVC Main 10 | HEVC Main 10 |
| Maximum resolution | 3840 x 2160 x 60 | 3840 x 2160 x 60 |
| WCG | BT 2020 | BT 2020 |
| HDR | ST 2084* | HDR-10/HLG |
| Backward compatibility | Receiver based | HE based |
| Audio | NGA recommended | 5.1 |

*HDR10, DV, Technicolor-Philips*

Good alignment between recommendations

# Other Ultra HD Forum Liaisons

DVB
ATSC
BDA
DECE
SMPTE
DASH Industry Forum
ITU-R
CableLabs
CableLabs Europe
Ultra HD Alliance
CEA
MPEG
Streaming Video Alliance (SVA)
Video Services Forum (VSF)
FAME

# Membership Information

- Our goal is for our members to shape the next generation of entertainment service delivery
- We, the members, are here to make meaningful progress and show results
- Our dues structure is designed to create a forum where any company in the industry can afford to join and have their voice heard; not to have meetings in exotic locations
- Participation is key to success so we encourage everyone to join

| Membership Level | Description |
| --- | --- |
| Charter | Can be elected as Board member<br>Can vote for Board Members<br>Can Chair a Working Group |
| Contributor | Can vote for Board Members<br>Can Chair a Working group |
| Associate | Must be less than $10M revenue / year |

# Adoption Guidelines

# Ultra HD Forum Phase A Guidelines

- Phases, Timeframes, Use Cases
- Real-time Linear Services
  - End-to-end Workflow
- HDR/WCG Technologies
  - PQ, HLG
  - BT.709, BT.2020
  - Peak Brightness
  - SDR<>HDR Conversions
- Security Recommendations

- Production & Post Production
  - Pre-recorded Content
  - Live Content
- Distribution Supply Chain
  - Contribution
  - Primary Distribution
  - Final Distribution
  - Ad Insertions, Crawl Overlays
- Decoding & Rendering
- Backward Compatibility

Guidelines coverage
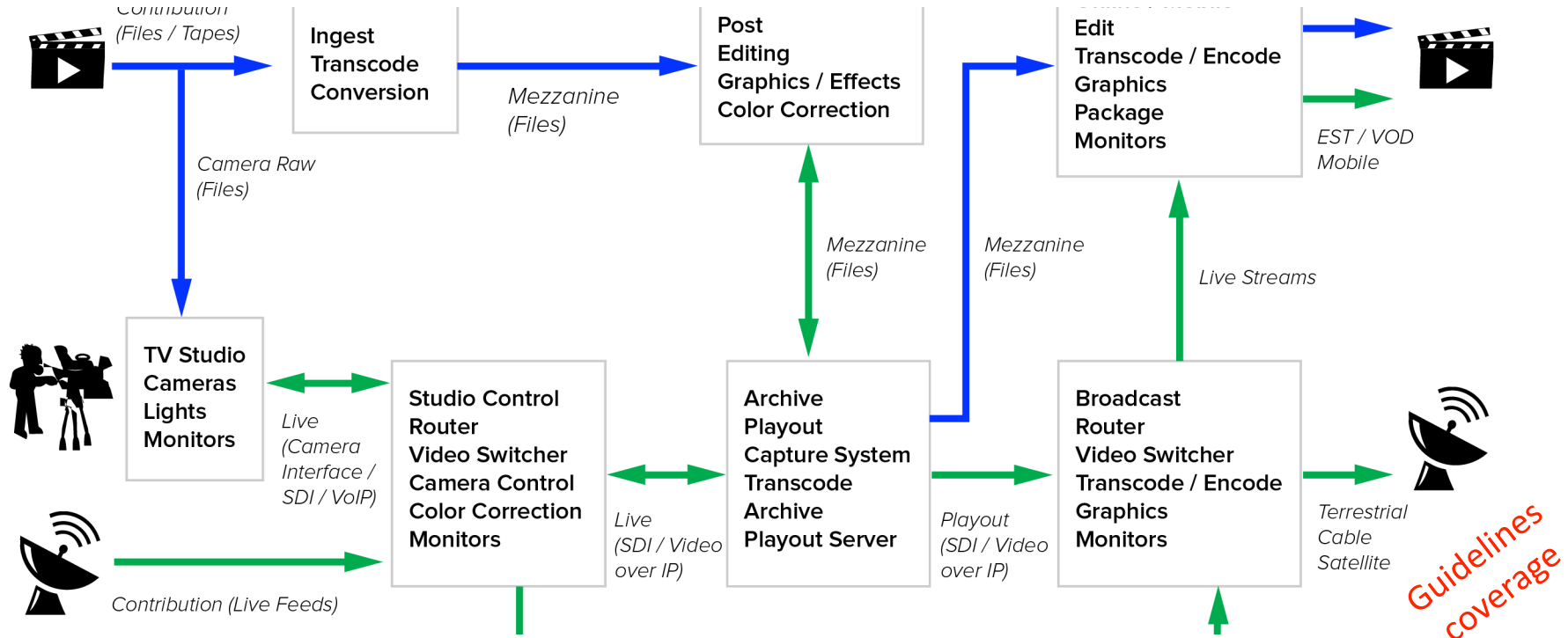
# UHD Phase A Definition (1/10)

| | |
|---|---|
| Spatial Resolution | 1080p* or 2160p |
| Color Gamut | BT.709, BT.2020 |
| Bit Depth | 10-bit |
| Dynamic Range | SDR, PQ, HLG |
| Frame Rate** | 24, 25, 30, 50, 60 |
| Video Codec | HEVC, Main 10, Level 5.1 (single lyr) |
| Audio Channels | Stereo or 5.1 multi-channel audio |
| Audio Codec | AC-3, EAC-3, HE-ACC, AAC-LC |
| Captions/Subs Coding (in/ out formats) | CTA-608/708, ETSI 300 743, ETSI 300 472, SCTE-27, IMSC1 |

*1080p together with WCG and HDR fulfills certain use cases for UHD Phase A services and is therefore considered to be an Ultra HD format for the purposes of these guidelines. 1080p without WCG or HDR is considered to be an HD format. The possibility of 1080i or 720p plus HDR and WCG are not considered here. HDR and WCG for multiscreen resolutions may be considered in the future.

 **Fractional frame rates for 24, 30 and 60 fps are included, but not preferred. Lower frame rates may be best applied to cinematic content.

Guidelines coverage

# UHD Phase A HDR and WCG (3/10)

- HDR10       CTA definition
- PQ            SMPTE ST 2084 definition
- PQ10        Ultra HD Forum definition
  - PQ EOTF, BT.2020 color gamut,10-bit depth
- HLG          Draft New Rec. BT.[HDR-TV] definition
- HLG10      Ultra HD Forum definition
  - HLG OETF, BT.2020 color gamut, 10-bit depth
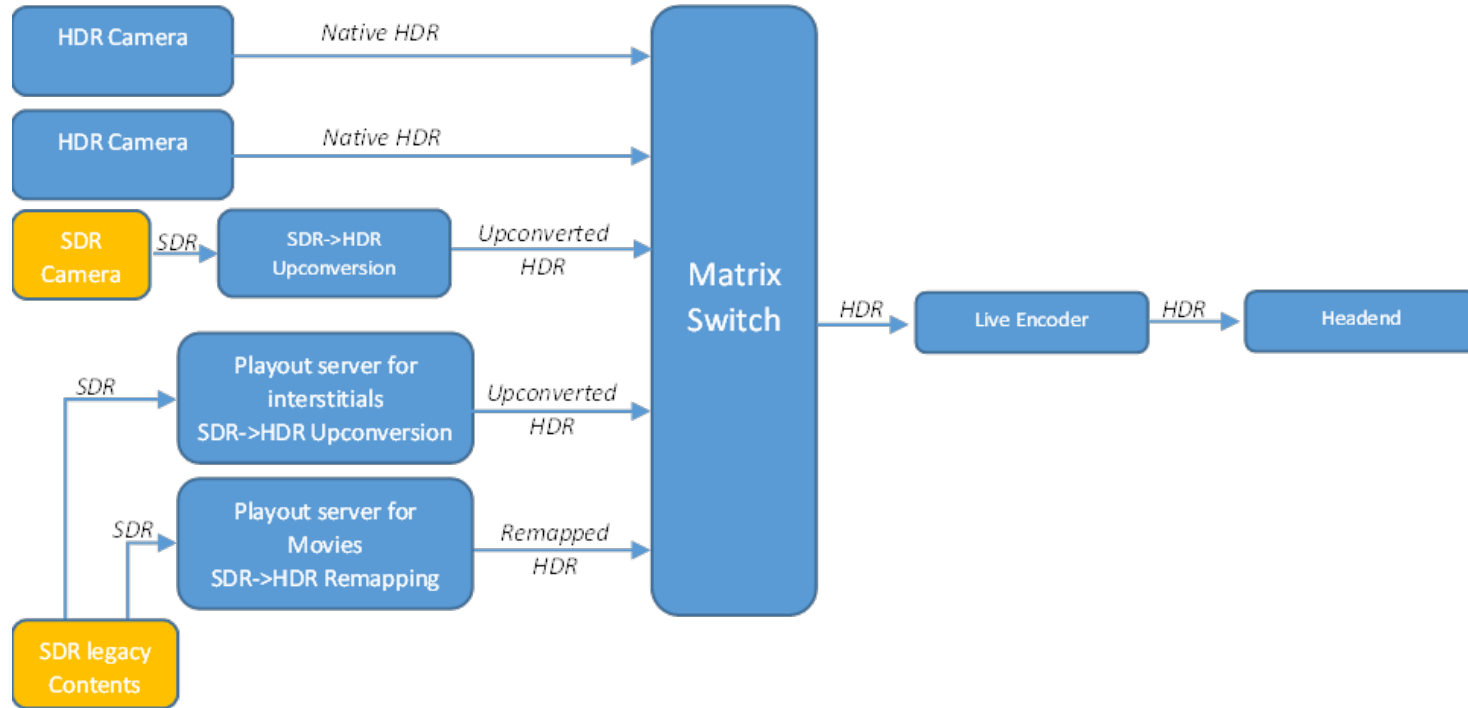
*Guidelines coverage*

# SDR<>HDR and PQ<>HLG  (4/10)

- Mechanisms used to convert or map
  - between SDR and HDR
  - between HDR technologies
- Use cases to illustrate
  - where in the distribution chain to convert
  - which conversion method to choose
  - peak brightness considerations

Guidelines coverage

# Mixing HDR with SDR  (5/10)

# Signaling/Metadata Carriage (6/10)

- HDR10 metadata carriage
  - work-a-rounds where standards do not yet exist in the workflow
  - e.g. compensate for lack of HDR metadata carriage over SDI

- Signaling
  - transfer function
  - color container

Guidelines coverage

- End-to-end workflow for real-time linear service
  - live and/or pre-recorded content
- Production > Broadcast Center > Service Provider > Consumer
- At each point in the chain describe:
  - compression technologies and bitrate ranges
  - metadata carriage options
  - audio
  - captions and subtitles
  - content manipulation: ad insertion, graphic overlays, etc.

Guidelines coverage

# Security (8/10)

- Security requirements are evolving and solutions need to stay ahead of piracy techniques

- The Guidelines contain recommendations for a secure system in 2016, including
  - key size
  - encryption technologies

Guidelines coverage

# Decoding & Rendering (9/10)

- Consumer decoding and rendering devices
- Key parameters to process UHD Phase A content
- Displays, STBs and Interfaces
  - identify UHD parameters not carried over HDMI 2.0a
  - timeline of standards development, equipment upgrade possibilities
- Rendering closed captions or graphic overlays

Guidelines coverage

# Backward Compatibility (10/10)

- Address UHD displays that are SDR only
  - Some process BT.2020, others only BT.709
- Various backward compatibility options explained
  - Simulcast, Unicast, Down-conversions
- Options described in context depending on, e.g.:
  - PQ or HLG
  - Type of service provider
  - Quality requirements
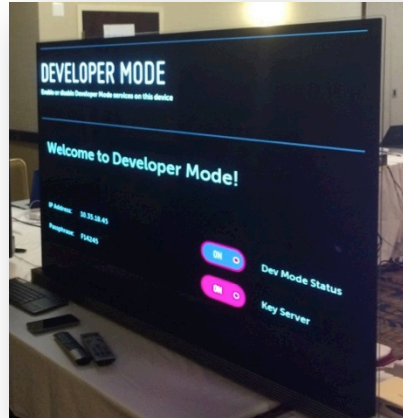  - STB footprint

*Guidelines coverage*

# Interoperability Plug Fest #1
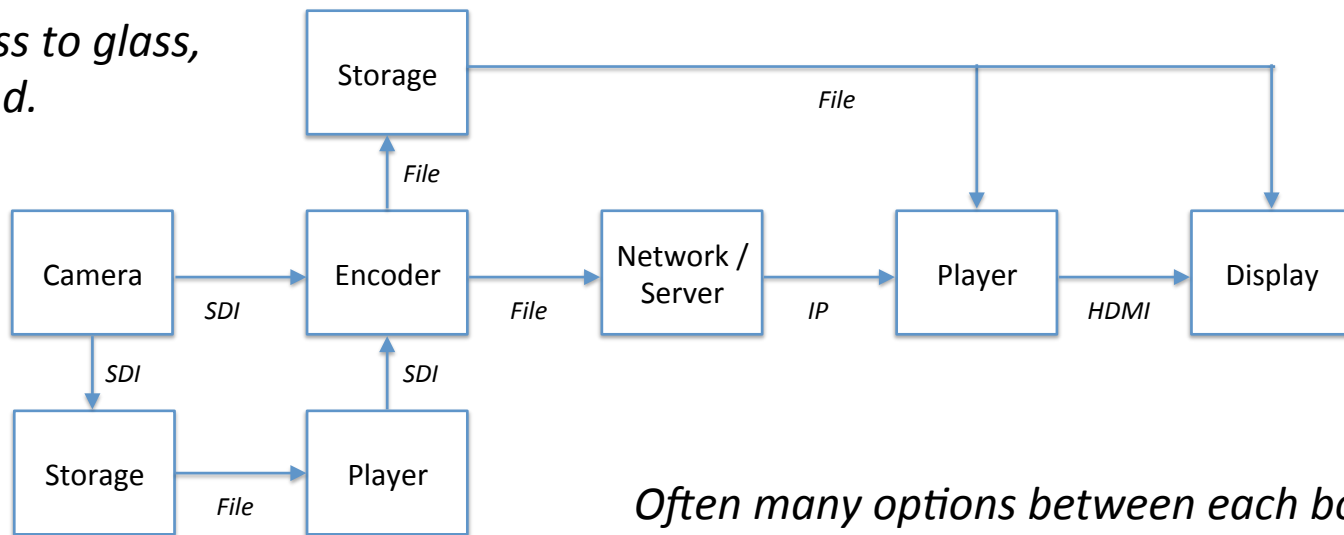
# Plugfest #1 Focused on Action

- 9 members involved
- HDR via HLG and PQ
- Live capture from camera
- Various devices and displays
- A confidential event for members. It was not a demo
- Due to Plug Fest #1 some real products got updates
- Plug Fest #2 in planning

# Plugfest #1 General Workflow



*Goal: Glass to glass, end-to-end.*

Storage

*File*

Camera — *SDI* → Encoder — *File* → Network / Server — *IP* → Player — *HDMI* → Display

*SDI*

Storage — *File* → Player — *SDI*

*Often many options between each box.*

# Plugfest #1 Points to Share



- Former video constants are now variables with Ultra HD; and they ripple through the end-to-end workflow. It is more than a resolution increase.
  - 8 bit to 10 bit depth.
  - 709 to 2020 color space.
  - HDR signalling.
- If you can see the picture, it does not mean it is correct.
  - Important to understand your content.
  - Recognize meaningful areas.
  - Test signal usage.
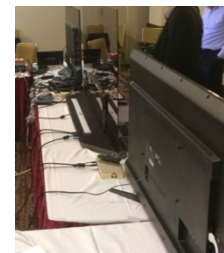
# Plugfest #1 Learning Together



- In addition to testing there were plenty of great discussions.
- In many ways it was also a workshop, and the event fostered more expertise in Ultra HD technology.
- Real world testing is invaluable at this stage to understand all the dynamics of Ultra HD technologies.

# Global UHD Deployments



Videocon
Inspur
Dalian Tiantu
Comcast
DirecTV
Netflix
Amazon
M-Go
Sony
Tricolor
BT
NHK
Fransat
Free

NTT
SkyPerfecTV
SkyLife
UMAX
KT
SKBB
LG Uplus
Tata Sky
Waiku tv
Fransat
Vudu
Brightcove
Waiki TV
SES

# Key Outstanding Challenges

- In "normal" circumstances does this tech represent a "wow" change like SD to HD

- Do we need a higher level of certified "Ultra HD Premium" that takes us beyond 1,000 nits

- Will bandwidth constraints / caps restrict Ultra HD to a niche

- Will HLG really provide useable, albeit limited, backward compatibility

- Will 2 competing EOTFs (HLQ and PQ) fragment the market or can both be supported

- Will licensing issues for elements of Ultra HD technologies constrain content availability

- Will HDR and SDR mixed content cause consumer issues or will conversion in the CPE mask this

- Will 709 and 2020 mixed content cause consumer issues or will conversion in the CPE mask this

# UHD Perspectives



- ## Keynotes: 15:30 – 16:45
  - Massimo Bertolotti – Sky Italia
  - Phil Laven – DVB
  - Andy King – BBC
  - Daniel Gauna – Infront
  - Francesco Donato – Video Progetti

- ## UHD Q&A: 16:45 – 17:00

- ## UHD Roundtable: 17:00 – 18:00
  - Guillaume Athuis: Bbright
  - Markus Fritz: Eutelsat
  - Anirban Majumdar: Dolby
  - Ludovic Noblet: IRT B-Com
  - Stuart Savage: LG
  - Ian Trow: Harmonic

# Plugfest #1 More to Share

- TV processing and modes have significant impact on the final picture.
  - Some dramatic changes, even more so then turning on HDR processing.
  - See sidebar on different quality gaps over time. It makes senses for this modes to exist, but now more complex, hence signaling is important.
- A broad content repository is important for testing.
  - The combinations have to be organized.
  - We came up with 12 content variations and 12 display variations to test. Still more to do.

*Different Quality Created Gaps*

Signal (S)    Display (D)

1    Early:
S > D
S ~ D
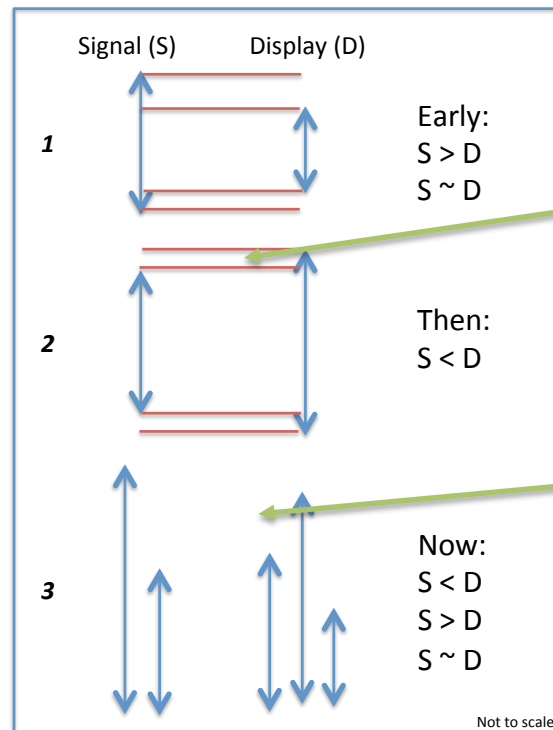
Pressure to fill the gap, it does make the picture look better.

2    Then:
S < D

3    Now:
S < D
S > D
S ~ D

Now variable gaps, and we need to handle the complexity.

Not to scale