

# Apple

Apple Pro Display XDR - **demonstrating recent standardization efforts in HDR digital still imaging.**

## ISO TS 22028-5 HDR still photos

Demonstrating how these images can be tone mapped to SDR, according to a tone mapping algorithm candidate for the next revision of ISO 22028-5.

*ISO TS 22028-5 provides requirements and guidelines for colour encoding of HDR/WCG still images. It is based on ITU-R BT.2100-2, to ensure full compatibility with existing HDR/WCG devices and the associated video and movie ecosystems.*

## Adaptive HDR - Headroom-based approaches, tailored for HDR playback on smartphones in various environments

This demo introduces the concept of ISO gain map and shows how ISO gain map is leveraged for image-specific headroom management.

*ISO DIS 21496-1 defines a gain map used in HDR digital photography applications, for dynamic range conversion between two image representations. This includes the definition of the gain map metadata and its attributes, how to specify the gain map and associated metadata, and how to apply the gain map using this metadata*

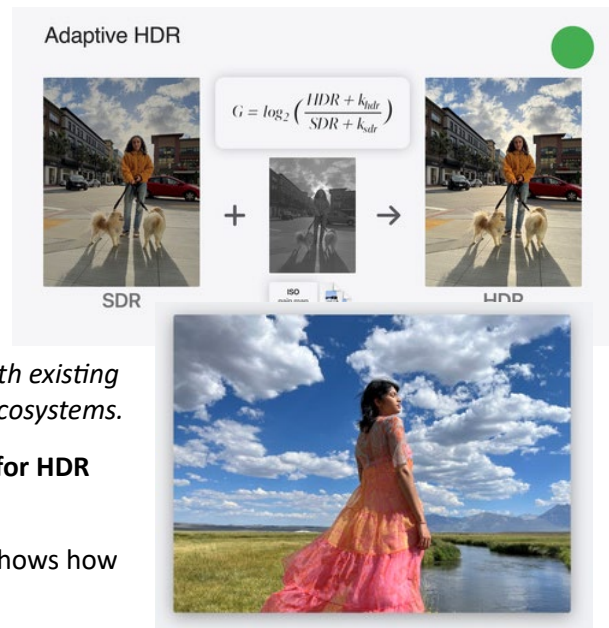
This demo introduces the concept of ICC gain curves and shows images encoded according to ISO 22028-5 with the new ICC gain curve stored in the ICC profile, and show how the ICC gain curve is leveraged for image-specific headroom management.

## Relevant links:

[ISO HDR Images Test Sets](#)

ISO Reference documents (fee required)

[ISO/TS 22028-5:2023 and ISO/DIS 21496-1 \(under development\)](#)



## NHK (Japan Broadcasting Corporation)

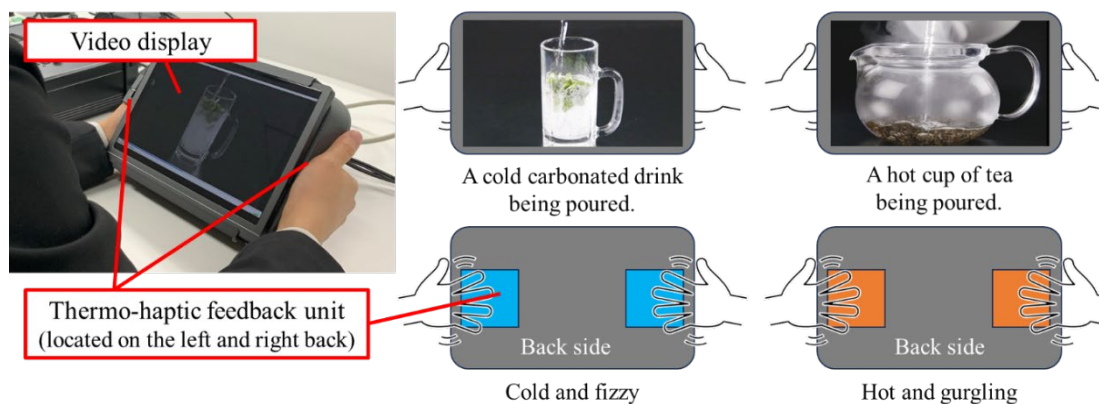
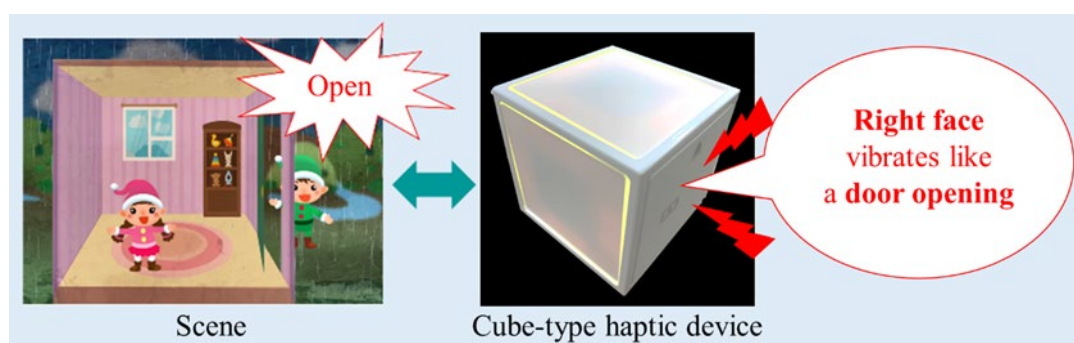
This demonstration explores two types of haptic devices:

- 1 a cube-type haptic device that allows users to feel events in video content realistically via vibration-based tactile feedback; and
- 2 a video display with a thermo-haptic feedback unit that delivers warmth or cold to the user's hands in addition to the vibro-tactile sensation from objects in the video scene.

For further details:

<https://doi.org/10.36463/idw.2023.0719>

<https://www.nhk.or.jp/strl/english/publica/annual/2023/6/4.html>



## Direct-to-Vehicle: ATSC 3.0/Layered Division Multiplexing

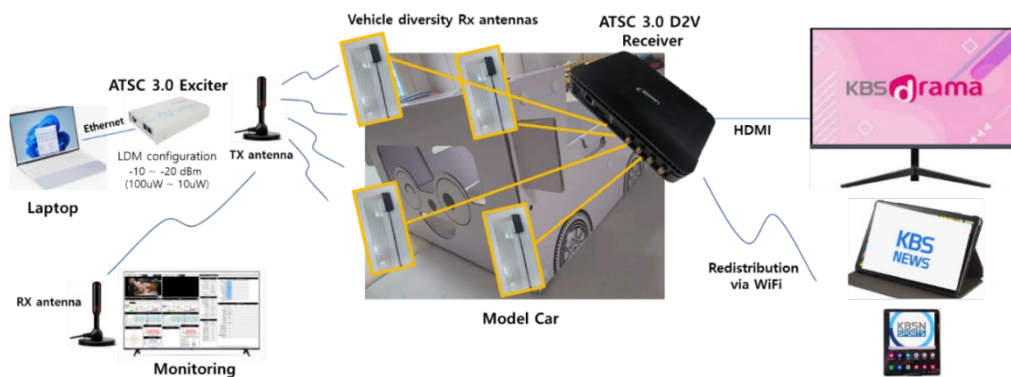
Direct-to-Vehicle (D2V) broadcasting is based on ATSC 3.0 with Layered Division Multiplexing (LDM) and offers a powerful solution for delivering a wide range of digital content to vehicles. This technology will significantly make driving safer, more informative, and more enjoyable.

### Demonstration

1. **Core Layer:** Delivers two HD contents with 720p quality
2. **Enhanced Layer:** Carries four FHD contents with 1080p quality
3. **ATSC 3.0 D2V Receiver:** Using four receiving antennas

### Use Cases

- ✓ **In-Car Entertainment** where passengers can watch live TV, movies and more...
- ✓ Real-time updates for navigation, traffic conditions and route recommendations...
- ✓ **Emergency Alerts:** critical information such as weather warnings & public safety alerts
- ✓ **Software Updates and Telematics:** Over-the-air updates for vehicle software & systems
- ✓ **Enhanced GPS:** Providing high accuracy (cm-level) positioning signal through OTA



### Demo Parameters

|                     |                               |                                |
|---------------------|-------------------------------|--------------------------------|
| Bandwidth           | 6 MHz                         |                                |
| Waveform Parameters | 16K FFT, SP6_2, GI_1024       |                                |
|                     | LDM Core Layer (PLP)          | LDM Enhanced Layer (PLP)       |
| Targeted Service    | Mobile Service - 2 HDs (720p) | Fixed Service - 4 FHDs (1080p) |
| Video Codec         | HEVC                          | HEVC                           |
| Audio Codec         | MPEG-H                        | MPEG-H                         |
| ModCod              | QPSK & 10/15 LDPC             | 64QAM & 10/15 LDPC             |
| Injection level     | 8 dB                          |                                |
| Data Rate           | 6.5 Mbps                      | 19.5 Mbps                      |
| Required CNR        | 6.4 dB                        | 22.4 dB                        |



[tanooki.io](https://tanooki.io)

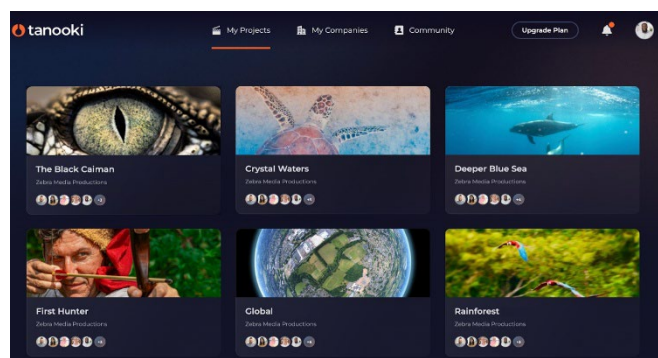
Post-production involves numerous complex processes, requiring content creators to juggle various software applications and licenses to collaborate effectively.

**tanooki** offers a streamlined, intelligent, and intuitive solution, enabling teams to follow content seamlessly from acquisition through post-production to final delivery. With **tanooki**, everything is accessible in one browser-based platform, where teams of any size can tap into the tools they need to create.

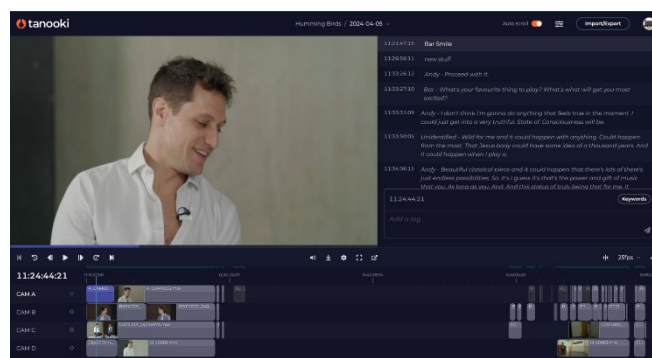
Developed independently in the UK by industry experts and backed by private investors, **tanooki** is a true British innovation with a mission to democratize the post-production process. The platform addresses an industry ripe for transformation, aiming to harness technology, foster better cultural practices, and create equal opportunities for new entrants. In today's tightening global financial climate, **tanooki** offers cost-effective solutions by enabling smarter, more efficient workflows.

**tanooki** serves as a secure, centralized gateway to the essential tools and talent required for modern media creation. With a single license, users can build teams, upload and sync dailies, create accurate transcriptions, access integrated workstations, share review files and live stream edit outputs within the platform's inbuilt video conferencing tool. **tanooki** simplifies the entire production process, empowering creators with a comprehensive, collaborative solution.

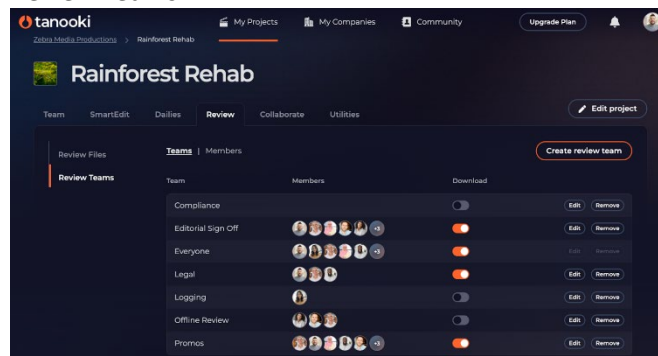
Project overview:



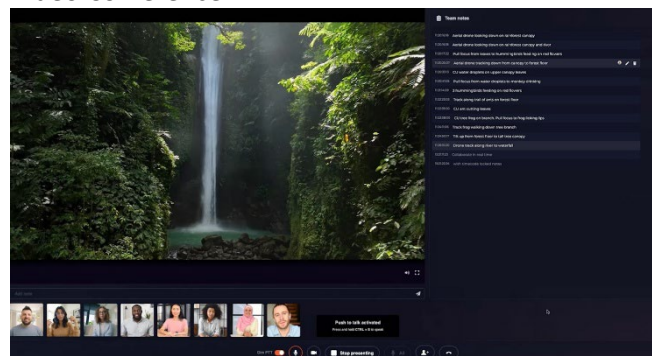
Dallies Viewer:



Review Teams:



Video Conference:







## DTS AutoStage Demonstration

DTS AutoStage brings the best of broadcast and IP services to enhance the user experience with content. Leveraging an IP connection in the radio product, AutoStage platform will expand access to information and services related to the broadcast program through deep linking of metadata. Additionally, the same deep linking approach can be used to provide additional recommendations for content based on the user's preferences. Finally, aggregating user requests through the IP connection, we can quantify the listening preferences and provide broadcasters and content providers with meaningful analytics based on location, time-of-day, and content preferences. These services are currently available for sound and video applications.

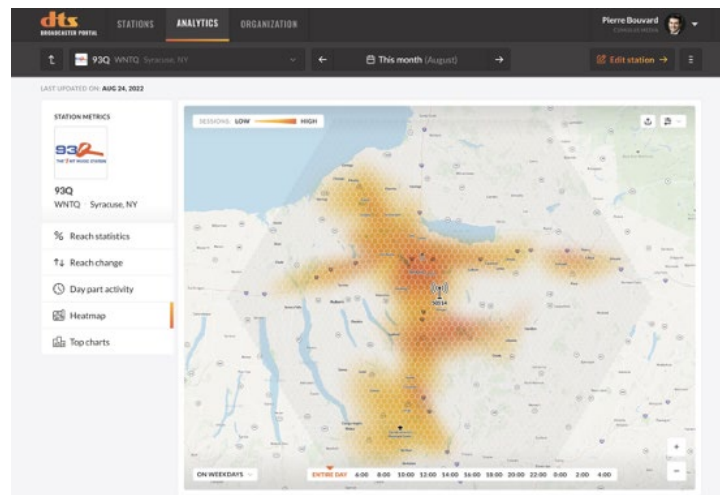
### DTS Autostage Audio Service



### DTS Autostage Entertainment Platform



## Analytics through IP connectivity



## HD Radio Demonstration

HD Radio is a digital broadcast protocol for AM and FM radio stations to expand their services and content offerings over a digital broadcast while maintaining the same spectrum allocation and transmission infrastructure as their analogue services. In the 5<sup>th</sup> generation product offerings, the technology is now deployed across portable consumer radios as well as embedded into smartphones and feature phones.

## Integrated HD Radio and Phone Functionality



### **Demo 1: SL-HDR1: Enabling High Dynamic Range content delivery 24/7 over NEXTGEN TV broadcast and OTT streaming**

Demonstration of HDR content delivery using the SL-HDR1 SDR compatible distribution format provided by Advanced HDR by Technicolor® solutions. The HDR content is rendered on a state-of-the-art HDR TV containing an integrated decoder for the SL-HDR1 format.

SL-HDR1 is the only HDR solution delivering live HDR content 24/7 throughout the USA over more than 125 NEXTGEN TV channels including Broadcast-Enabled Streaming TV channels.

SL-HDR1 has also been selected for deployment in Brazil for SBTVD 2.5 and SBTVD 3.0.



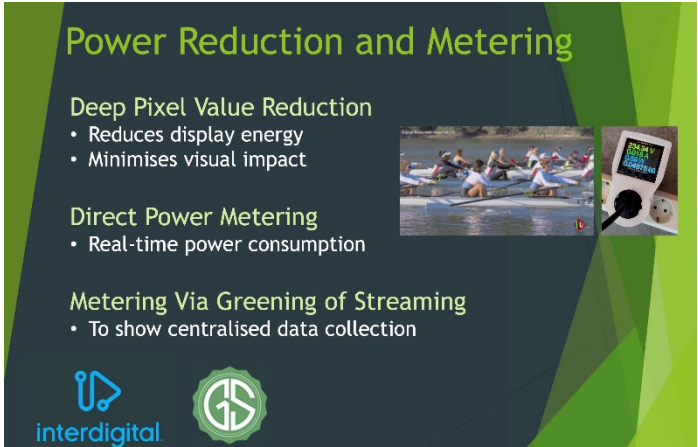
### **Demo 2: Un-compromised HDR content creation**

Live HDR production guidelines are in use to ensure consistent programme quality and exchange. One of the most important guidelines being the HDR Diffuse White level of 203 cd/m<sup>2</sup>. While helpful to allow consistent and easy HDR-SDR conversions using static techniques, this static diffuse white level also produces HDR content that could appear somewhat dull, not utilizing the full HDR potential. The demonstration shows the potential of dynamic HDR solutions, able to work with unrestricted diffuse white levels, to produce a more vivid and immersive HDR experience, while ensuring perfect HDR-SDR conversions thanks to dynamic metadata.

Broadcasting and streaming use energy throughout the transmission chain, but notably in end user devices. Televisions can reduce their energy consumption through content processing, for example such as described in Report ITU-R BT.2540, “display energy reduction through image signal processing”. The present demo shows the Deep Learning variant described in this report, which was contributed by InterDigital.

The method offers transparent energy reductions up to 20% for current OLED displays. The power metering is achieved by reading a power meter and displaying the values in real-time.

In addition, a second power meter reads values and sends them to a central server managed by Greening of Streaming, to show the possibility of collecting and reporting power usage, which will be useful for example when reporting of energy impact becomes mandatory.



**Power Reduction and Metering**

- Deep Pixel Value Reduction**
  - Reduces display energy
  - Minimises visual impact
- Direct Power Metering**
  - Real-time power consumption
- Metering Via Greening of Streaming**
  - To show centralised data collection

The slide features two small images: on the left, a group of rowers in a boat on water; on the right, a power meter device with a digital display showing '0.00W' and '0.00A'.

At the bottom left is the InterDigital logo, and at the bottom right is the Greening of Streaming logo, which consists of a green circle with a white 'G' and 'S' inside.



Related to the digitalization of the Broadcast and Pro-AV industry, more and more wireless equipment is deployed every day for live audio-video content creation and distribution.

Existing wireless equipment becomes today obsolete because users want the full duplex functionality of cables. But today, multiple radios and frequencies are needed to perform this function, while spectrum is becoming a scarce resource.

The market is demanding for new products, offering ultra-low latency and full duplex connectivity, using less spectrum, quick to set up and to operate by reduced operational crews.

This necessary migration and the emergence of new technologies is an opportunity to re-think the overall system and base the creation of live audio-video content on new emerging and powerful technologies.

In a project funded by INNOSUISSE, NuLink developed and integrated HEVC ULL compression, NDI-HX and 5G technology tools that can overcome the limitation of RF technology for wireless ultra-low latency and full duplex transmissions to answer today's market demands.

At the **ITU Workshop on the Future of TV for Europe**, NuLink will demonstrate a complete, fully wireless TV production studio based on a Private 5G Network, whose main features are:

- ✓ 50 MHz TDD channel in band n40.
- ✓ Full duplex IP connectivity.
- ✓ Intercom with smartphones.
- ✓ NDI cameras.
- ✓ ULL H.265 camera.
- ✓ Microphone and loudspeaker.
- ✓ Return video channel.
- ✓ Streaming over STARLINK or Fiber





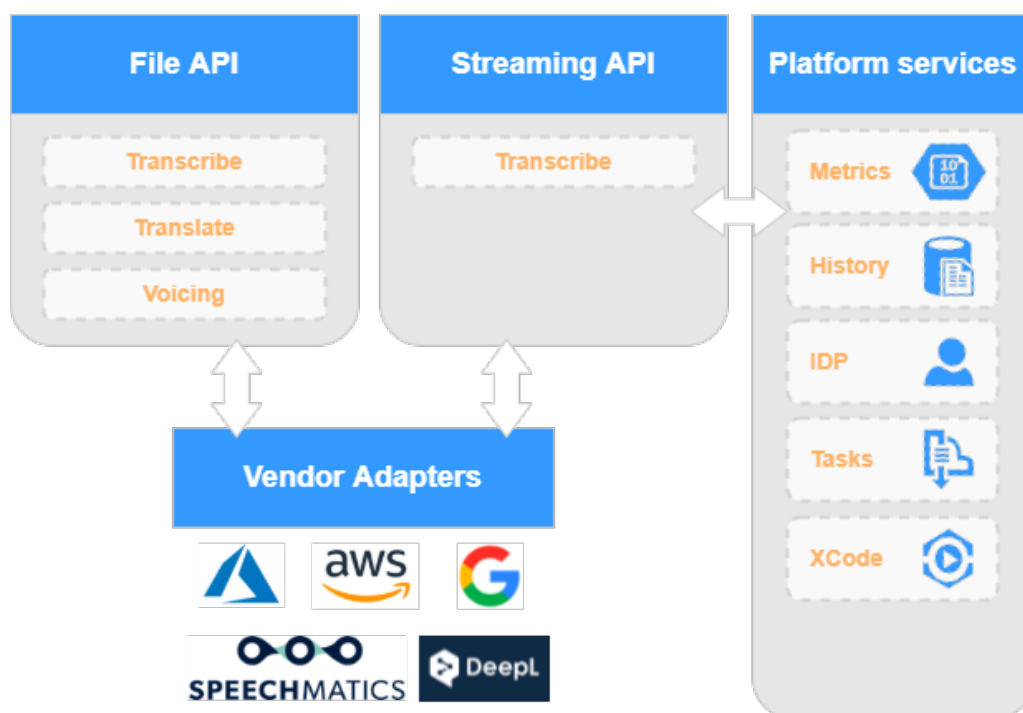
How EuroVOX, the EBU's AI-assisted multilingual media processing toolbox, can be used by content producers for both immediate accessibility needs as well as for future innovation.

EuroVOX is a collaboration between the EBU and its members, creating an open toolbox for transcription and translation technologies.

Being able to dynamically access different vendors, platforms and engines, gives you the ability to select the right tool for the right task. Having flexibility means you have access to the best results while minimizing complexity and development costs.

EuroVOX is available right now to address these challenges. It gives you the ability to have single API access to multiple language tools from multiple vendors and dynamically select between them, depending on the task at hand. It provides a fully functional abstraction layer between you and the vendor implementation.

The advantage of implementing EuroVOX on your own infrastructure, is that it gives you freedom to easily change vendors at a later stage. For example, if your organization decides to start producing content in a new language that requires a new vendor, you can change or add providers at the push of a button



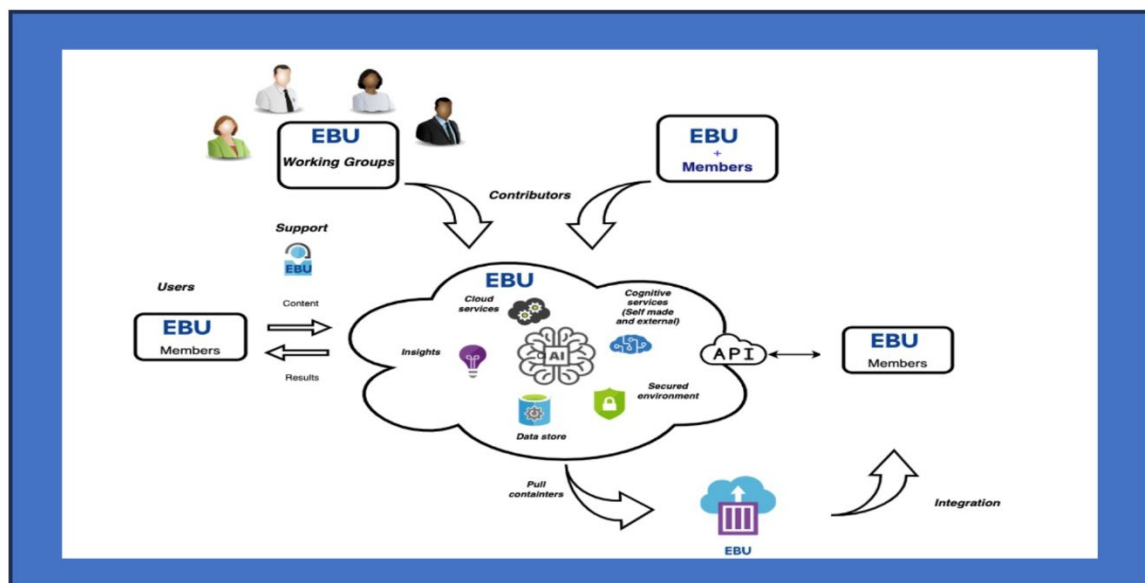
## AI Hub

The AI Hub, a collaborative platform for showcasing and evaluating custom AI models designed for media applications. It serves as a space for collaboration and innovation, where AI and media experts come together to push the boundaries of media technology

The EBU AI-HUB is an initiative that enables broadcasters to showcase, evaluate and share tailor-made AI applications. We first developed three applications covering audio, video and written media.

- Make AI tools developed by Members visible to foster collaboration
- Private workspace for users to upload and process audio, video and text with AI applications
- A dual-interface platform: API access for developers and an UI for end users

It is a hub to interact with the community and provide feedback to the designers

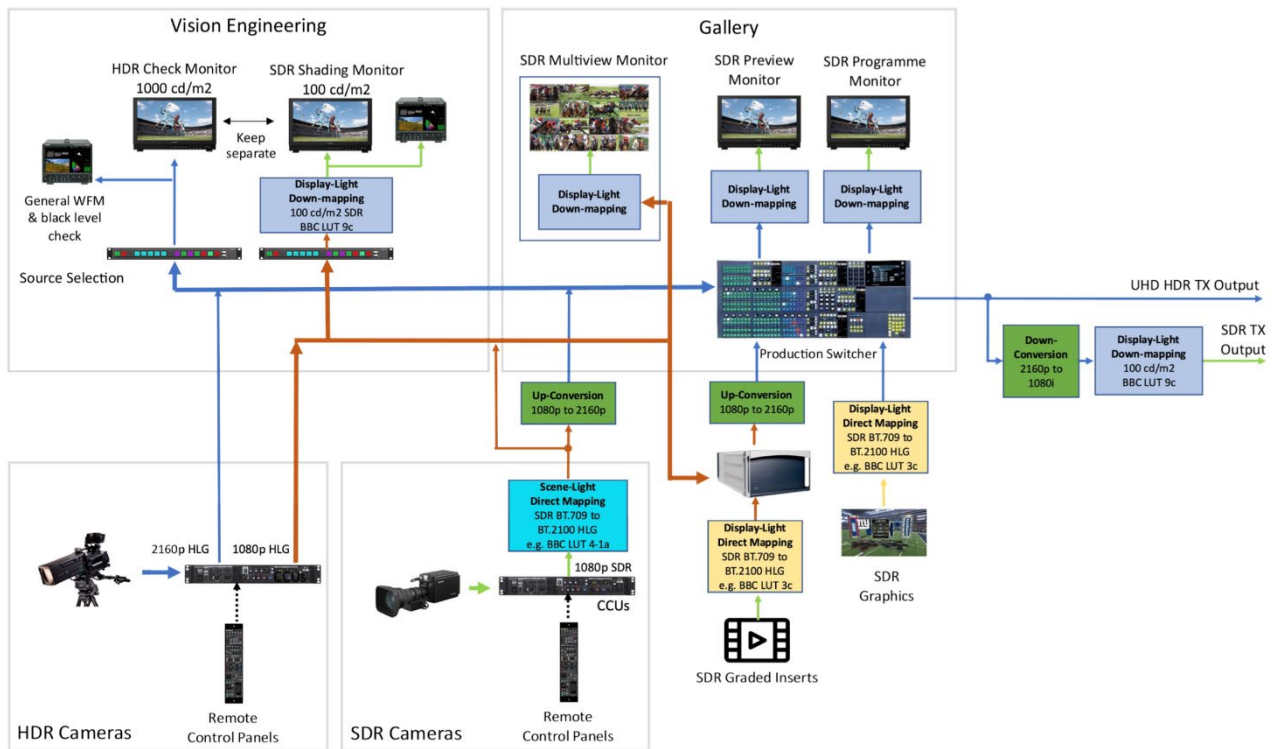


## HDR Workflows

The EBU and its members along with the ITU have been working on producing content targeted at multiple viewing devices for a number of years. In this demo we show a live conversion between HDR and SDR using the techniques listed in various ITU-R Reports.

However, more critically, we raise the issue that many broadcasters are beginning to see – the large and increasing range of display devices and viewing platforms, all of which need an optimised output.







## Where media meets connectivity

TV streaming services are a reality today with content being made available to audiences on connected devices such as smart TVs and mobile devices. Content delivery and management platforms, CDNs, clients, applications, analytics, data collection, recommendations, personalization, etc are constituting elements of the new media delivery framework.

3GPP technologies for media delivery can be used to deliver such services with enhanced Quality of Experience (QoE) and leveraging 5G core network features and functions, accessible through the 5G Media Streaming set of specifications. 5G Broadcast may also be used as a way to deliver internet-media streams over traditional broadcast infrastructure. On top, DVB-I may be also used to bring back the traditional TV experience with channel lists and EPGs beyond just apps.

5G-MAG has undertaken the task to convert specifications into software and products. This demo aims at putting 3GPP media delivery systems and DVB-I for TV streaming into practice.

### Pre-Standardization Work Market- & consensus-driven

### Post-Standardization Work Specifications into Deployments





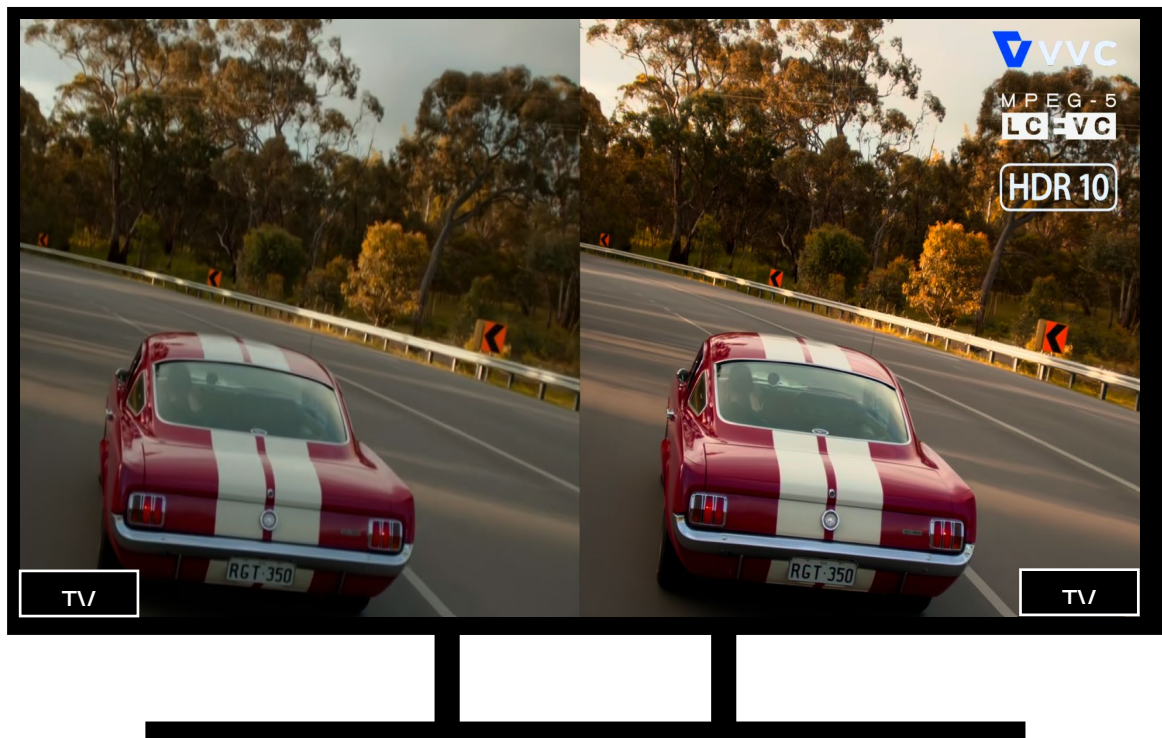


DTV+

## TV 3.0 – TV 2.0 Comparison

The demo compares TV 3.0 with the current TV 2.0 standard, highlighting enhanced 4K/UHD video with HDR, enabled by VVC, MPEG-5 LCEVC, and HDR10. TV 3.0 delivers four times the pixel resolution of HD, with 1 billion colours and an expanded BT.2020 colour gamut for sharper, more vibrant visuals.

Compression efficiency is significantly improved, as the combination of VVC and LCEVC reduce bitrates while maintaining high quality, allowing UHD broadcast at bitrates as low as 10Mbps. Together, these advances showcase TV 3.0's ability to provide a richer, more lifelike viewing experience, marking a significant upgrade in broadcast technology for mass-market deployment.

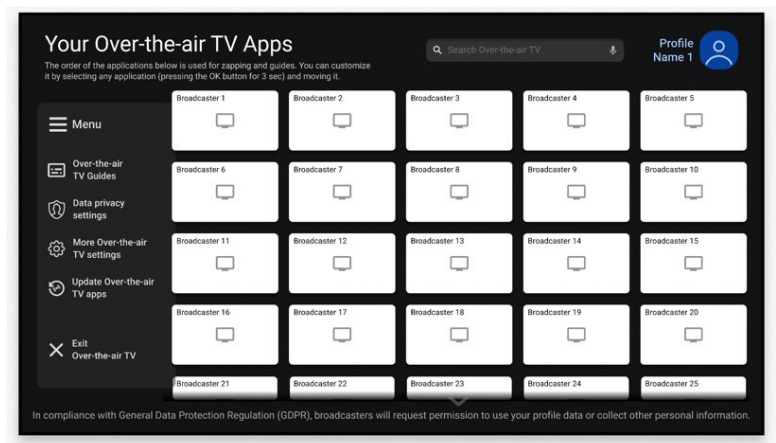




## Brazil Application oriented TV

Brazil's next-generation TV represents a fundamental shift in how viewers perceive, initiate, and interact with broadcast content. Combined with full broadcast-broadband IP convergence, the platform establishes a standardized "application-oriented TV broadcasting" paradigm designed to address these specific challenges and enhance user engagement.

The primary motivation behind this application-oriented approach aims to deliver a more intuitive and personalized experience, tailored to address the decentralized nature of Brazilian broadcasting. By creating a common application-oriented platform where broadcasters can leverage viewer profiles and authorized data, the model adapts dynamically to individual preferences and brings together fragmented content sources into a more cohesive user experience.



This DTV+ demo illustrates this viewer-centered journey, validating the application-oriented paradigm of TV broadcasting while addressing service discovery challenges in a decentralized landscape. The demo also pinpoints areas for further work, such as reducing friction points in access, enhancing compatibility with various software environments, and identifying new standardization and usability requirements.