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# MPEG-H Audio System for Broadcasting

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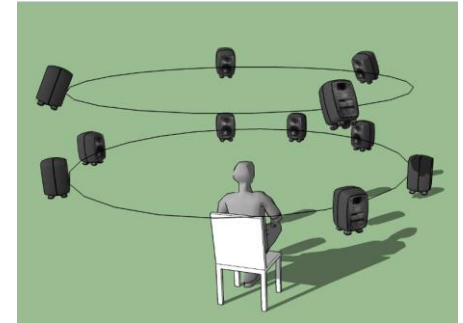
ITU-R Workshop “Topics on the Future of Audio in Broadcasting”

Jan Plogsties

# Challenges of a Changing Landscape

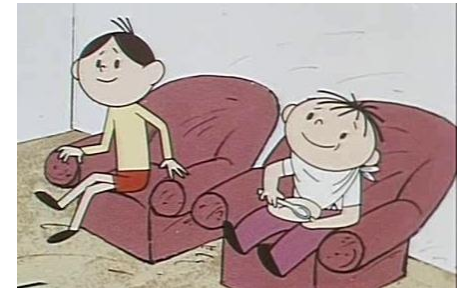
## Immersion

Compelling sound experience through sound that comes from all directions produced in different formats



## Personalization and interactivity

Adaptation to the user's liking and listening situation



## Everywhere

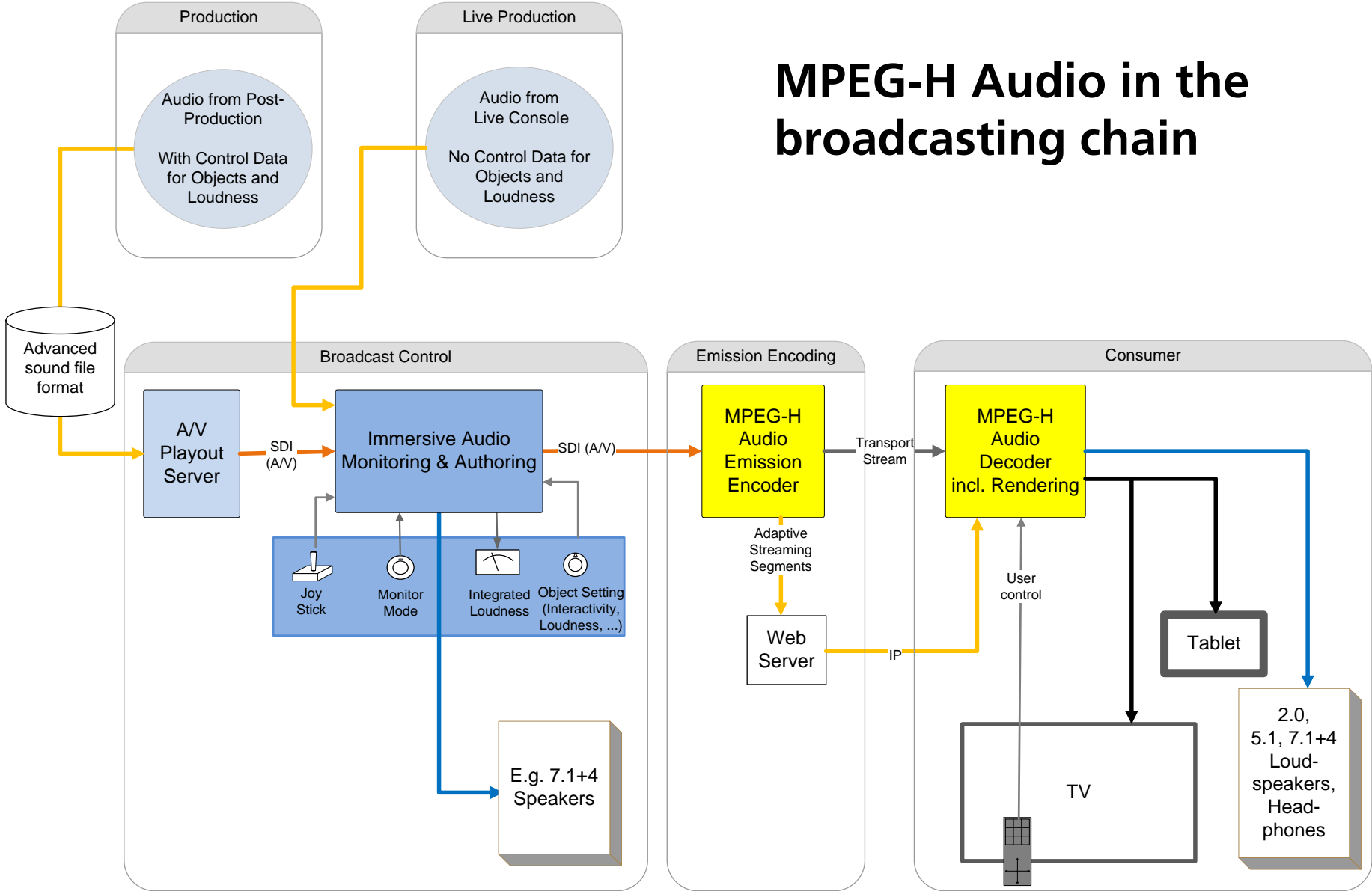
Play on any device with delivering best possible sound experience in terms of spatial impression and dynamic range



# What is MPEG?

- Moving Picture Experts Group (MPEG) is a working group of ISO/IEC
- MPEG has a 25 year history of delivering open standards for broadcast
  - like MPEG-2 Video and transport,
  - MPEG-4 AAC family of audio codecs,
  - MPEG-4 AVC or MPEG-H HEVC
- In 2013 a Call for Proposal was issued for technology for coding of immersive and interactive audio
  - Extensive testing and refinement over several meeting periods
- MPEG-H 3D Audio is International Standard since 2015

# MPEG-H Audio in the broadcasting chain



# Audio Content Types

- **Channel-based**

Mixes produced for a defined target loudspeaker locations


- **Object-based**

Sound of a single element and related metadata

- **Positional object** - Target locations or arbitrary movements specified by metadata
- **Interactive object** – Object that can be controlled by the listener

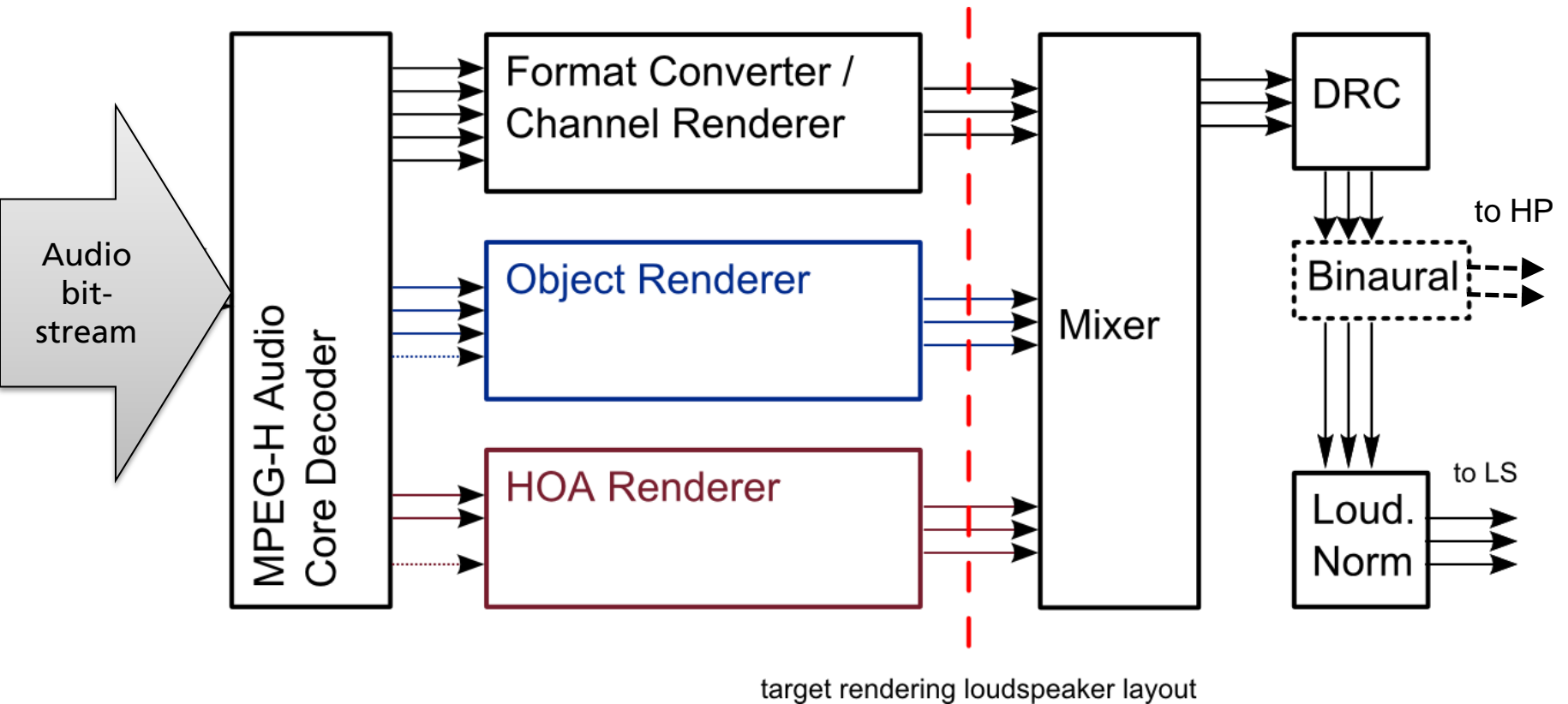
- **Higher Order Ambisonics (HOA)**

Corresponds to a spherical expansion of the sound field in a point



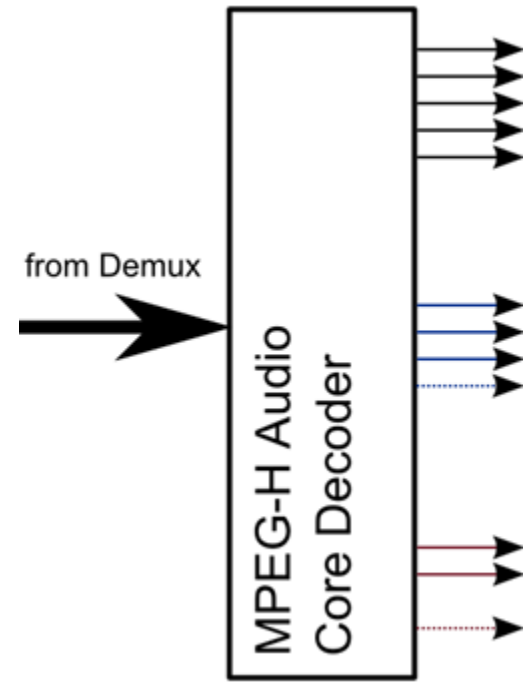
Speaker layout agnostic;  
Rendering to target loudspeaker setup

# MPEG-H Audio - Basic Decoder Architecture



# MPEG-H Audio Core Codec

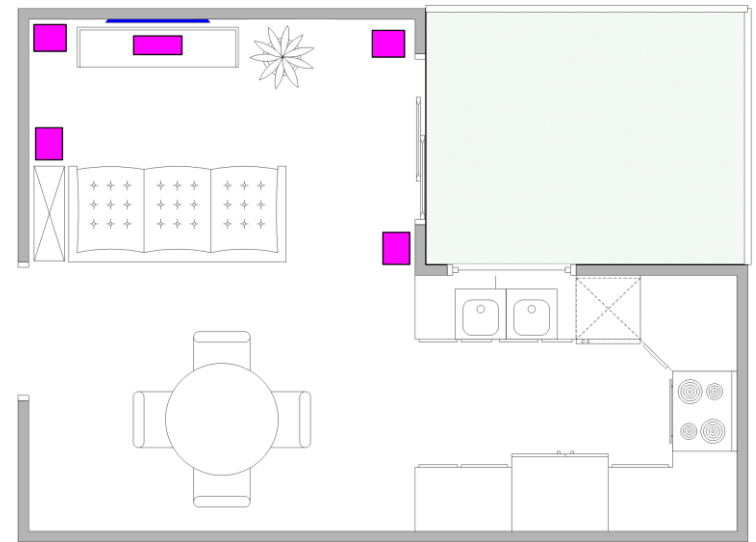
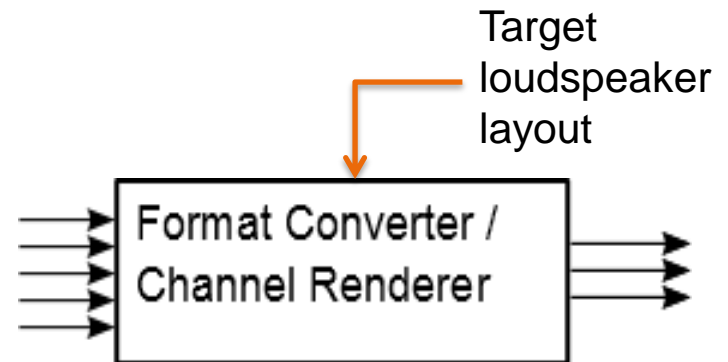
- Based on MPEG Unified Speech and Audio Coding (USAC)
- Extensions for use in the context of 3D audio
- Improved coding efficiency by parametric tools
  - Improved stereo and multichannel imaging
  - Instantaneous bit rate and stream switching
  - Signaling for 3D content/loudspeaker layouts



Bed	Objects	Total # of chan. + obj.	Total Bitrate (kbps)
7.1+4	3	15	504
5.1	3	9	288
2.0	3	5	180

# Format Converter / Channel Rendering

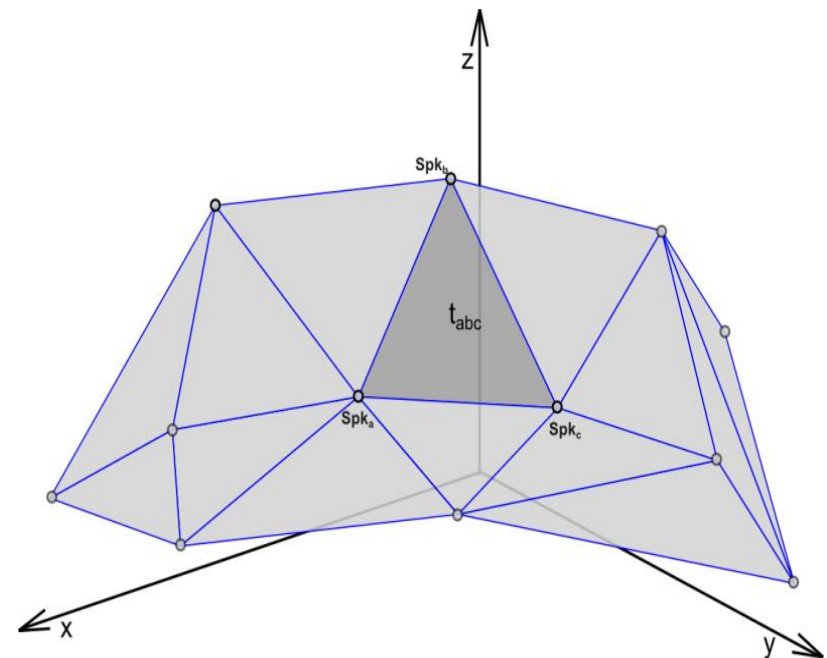
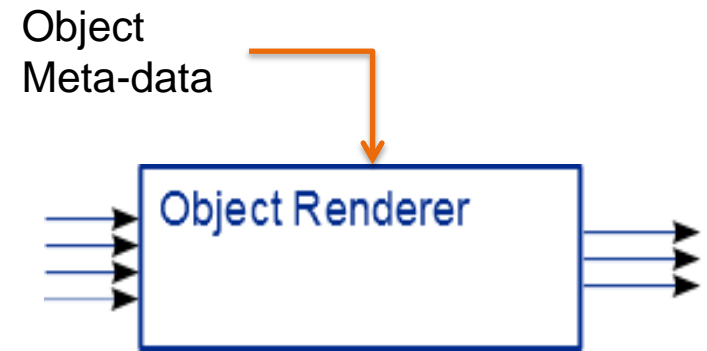
- Flexible Rendering to target loudspeaker layout
- Retains immersion as good as possible with available speakers; including height perception
- Intelligent downmix
  - Compensation of timbre coloration / signal cancellation effects
  - Automatic generation of optimized downmix matrices broadcast-controlled downmix





# Object Renderer – Positional Objects

- Object channel is played over a combination of available loudspeakers that are closest to the intended object position
- Dynamic Metadata is used to control object position
- Uses virtual loudspeakers in case too few loudspeakers are available

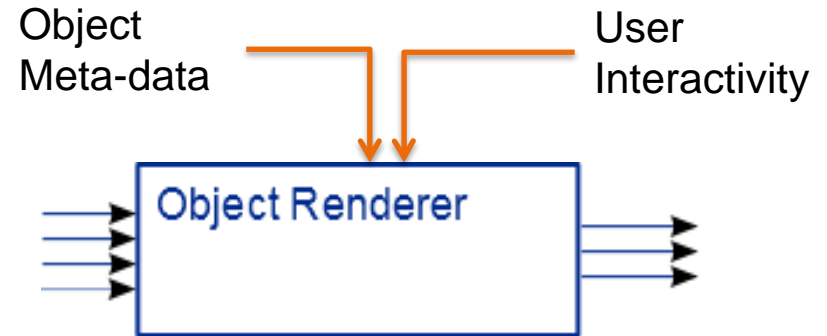


# Object Renderer – Interactive Objects

- Object = audio essence + metadata
- Interaction during playback:
  - Selection on/off
  - Level adjustment
  - Position

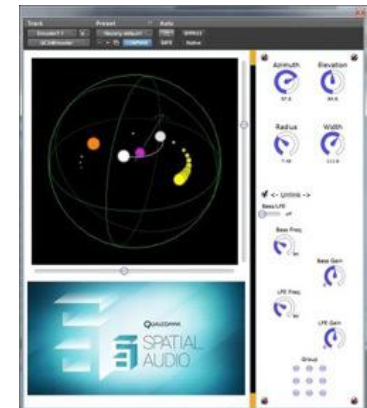
➔ fully controlled and restricted by metadata

- Presets are a combination of enabled and disabled groups, and a specific mix

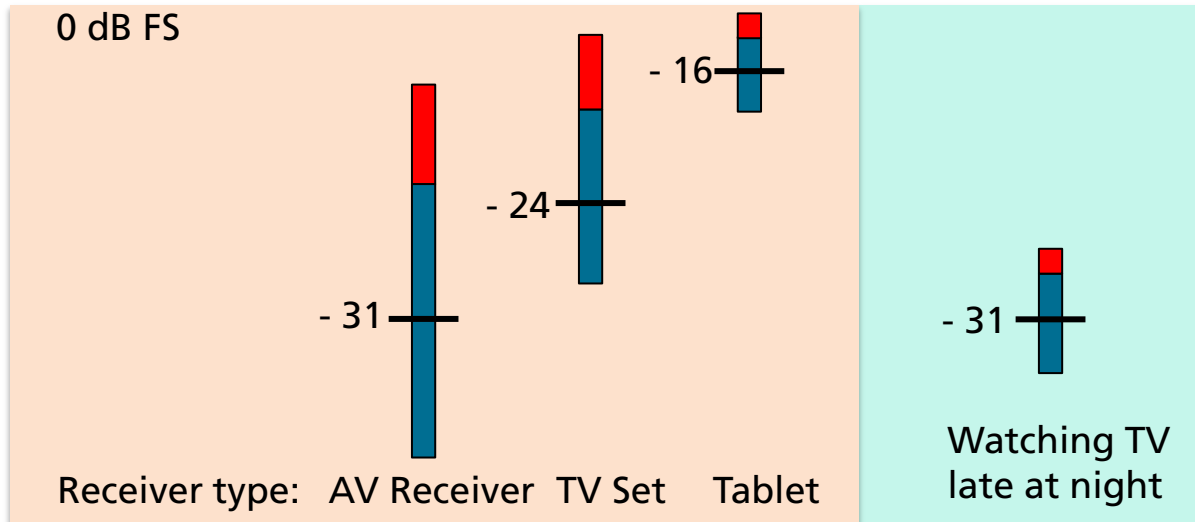
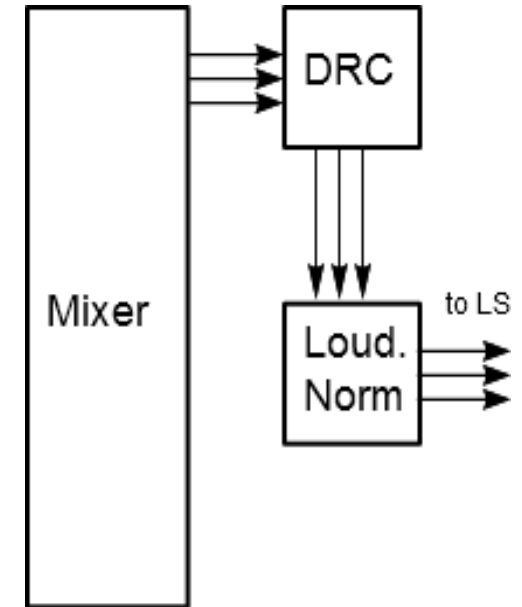
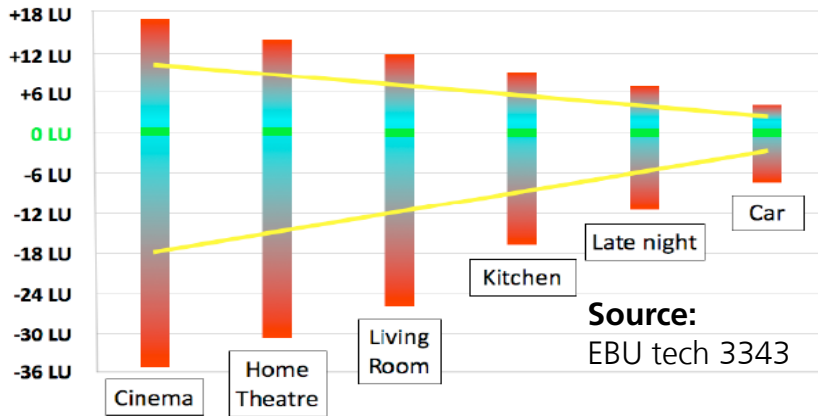


# Higher Order Ambisonics Renderer

- Dedicated coding scheme and renderer for HOA content
- Loudspeaker-independent, universal, representation of a sound field
- Multi-capsule microphone array
- Synthesize HOA signals
- Directly rendered to target loudspeaker layout

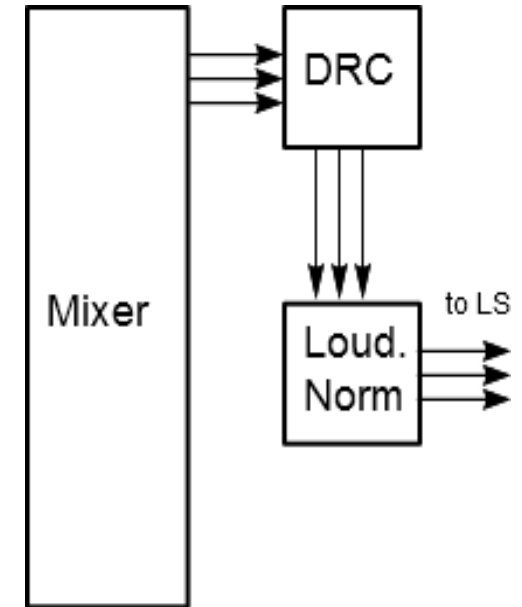
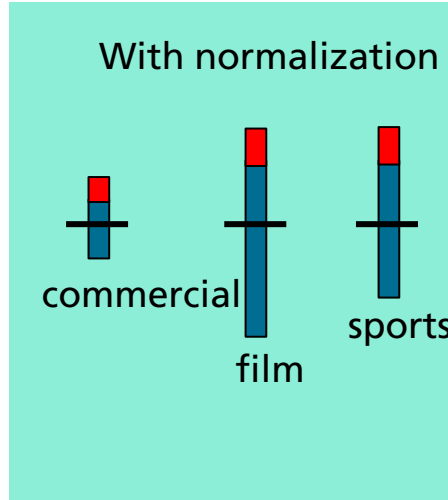
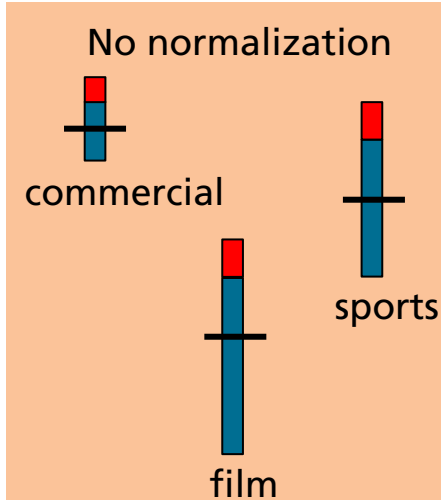


# Dynamic Range Control

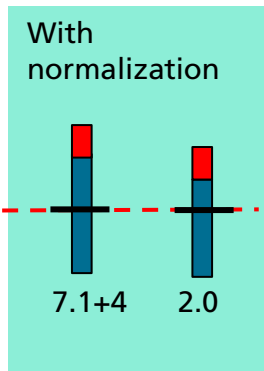
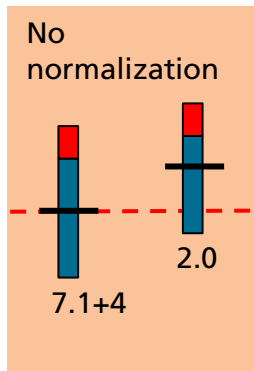


# Loudness Normalization

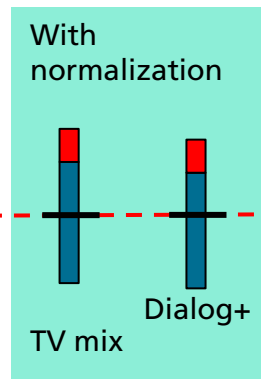
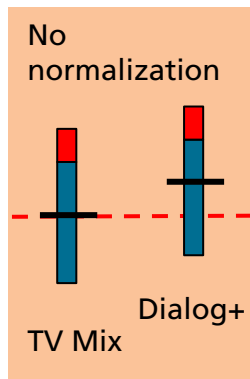
For different programs

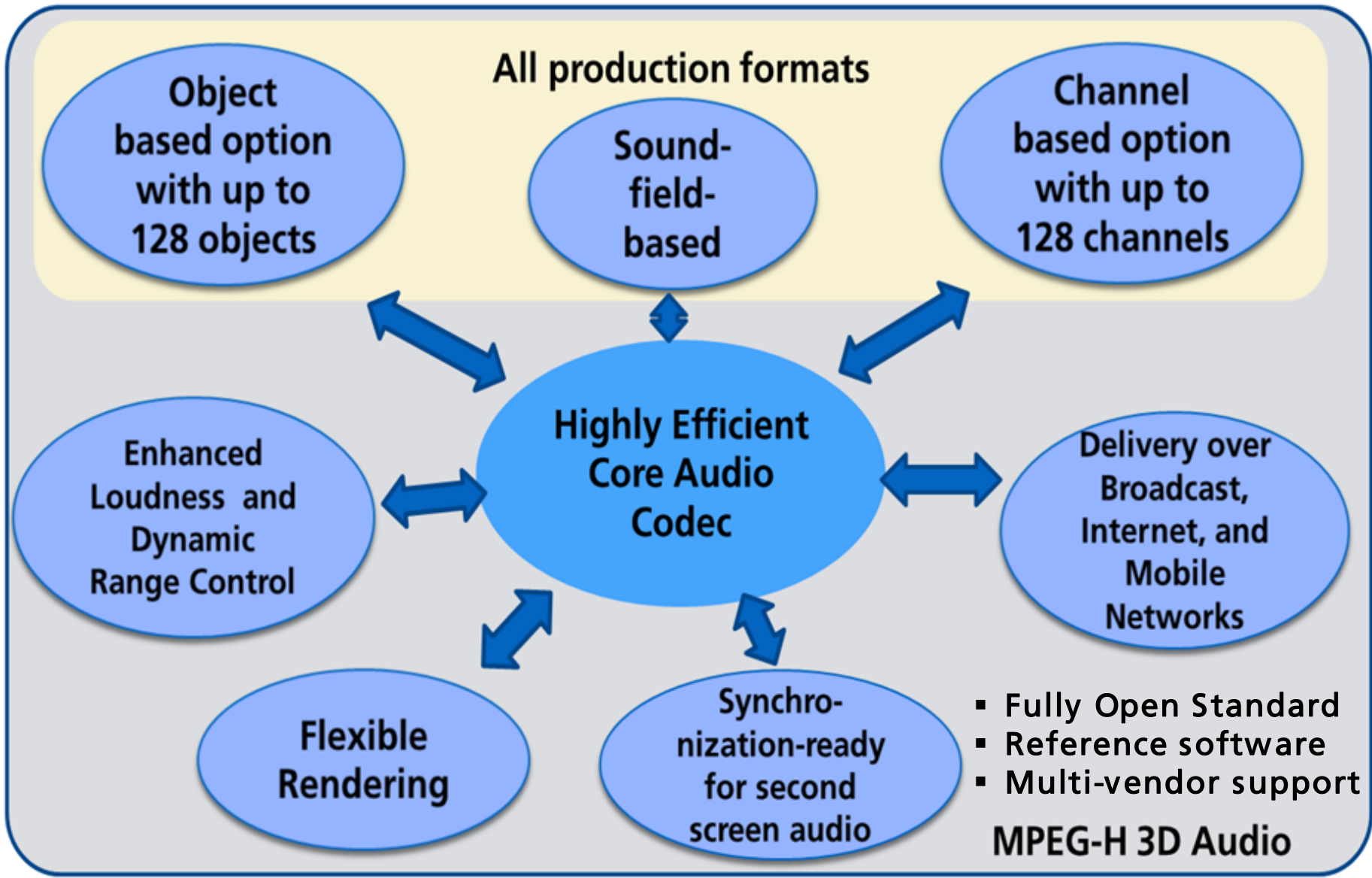


For different playback

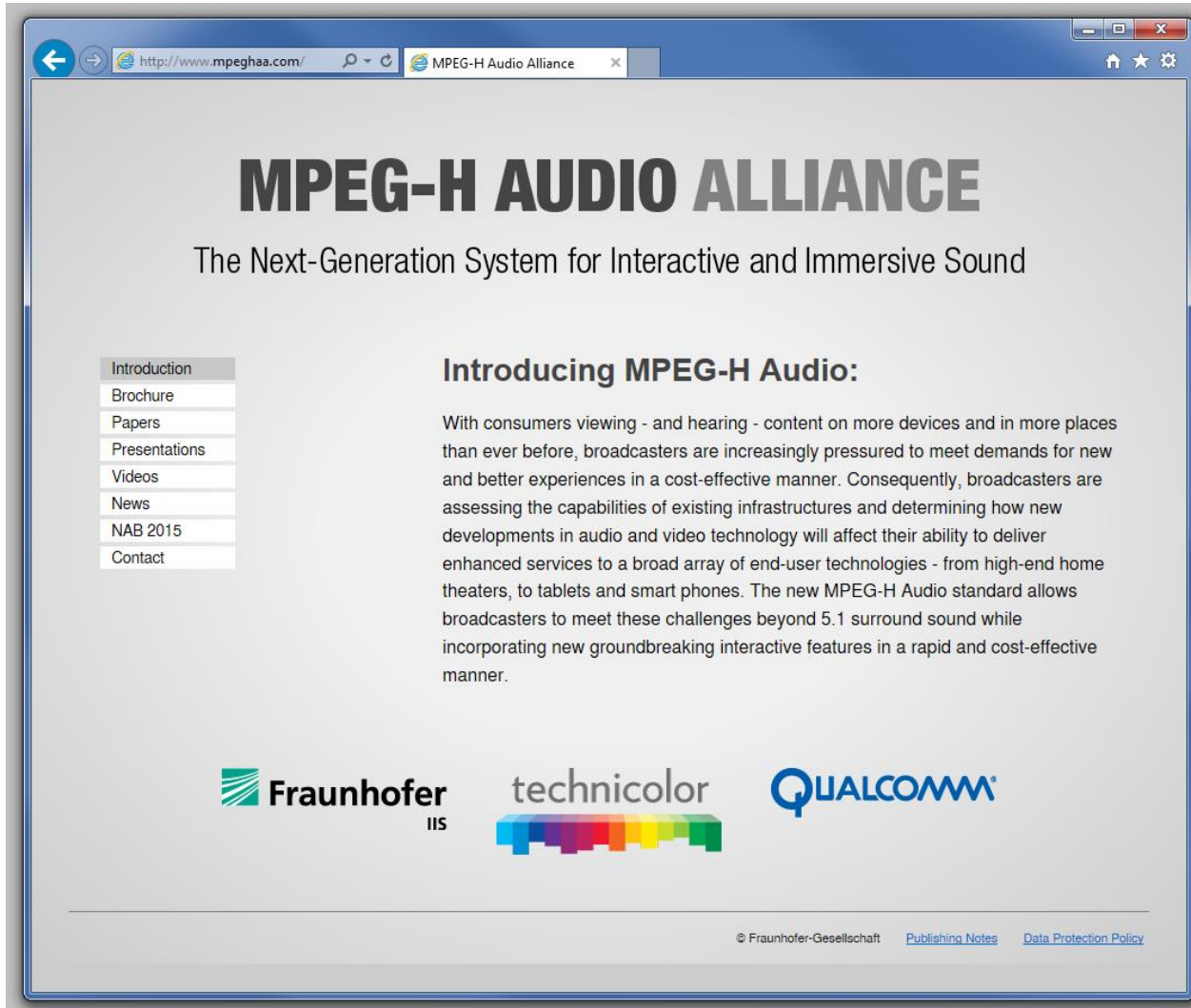


For different presets





# www.mpeghaa.com



The screenshot shows a web browser window with the URL <http://www.mpeghaa.com/> and a single tab titled "MPEG-H Audio Alliance". The page content includes:

## MPEG-H AUDIO ALLIANCE

The Next-Generation System for Interactive and Immersive Sound

- Introduction
- Brochure
- Papers
- Presentations
- Videos
- News
- NAB 2015
- Contact

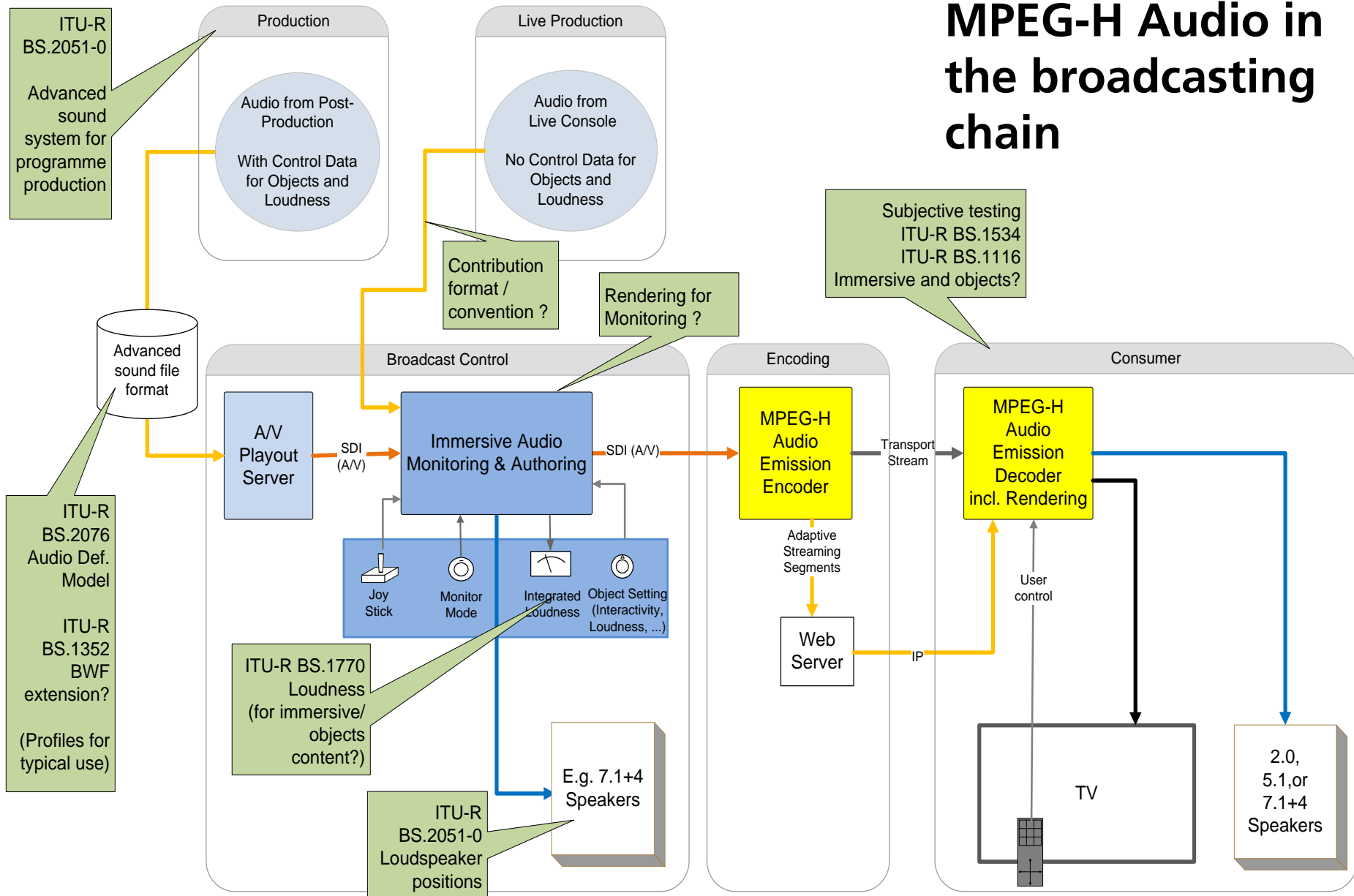
### Introducing MPEG-H Audio:

With consumers viewing - and hearing - content on more devices and in more places than ever before, broadcasters are increasingly pressured to meet demands for new and better experiences in a cost-effective manner. Consequently, broadcasters are assessing the capabilities of existing infrastructures and determining how new developments in audio and video technology will affect their ability to deliver enhanced services to a broad array of end-user technologies - from high-end home theaters, to tablets and smart phones. The new MPEG-H Audio standard allows broadcasters to meet these challenges beyond 5.1 surround sound while incorporating new groundbreaking interactive features in a rapid and cost-effective manner.

Logos for Fraunhofer IIS, technicolor, and QUALCOMM are displayed at the bottom of the page.

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# MPEG-H Audio in the broadcasting chain





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Thank you.

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