

Eurovision Song Contest 2023

Audio Trial

ADM-OSC in Production

28th September 2023 – Dave Marston

BBC
RESEARCH &
DEVELOPMENT

GOAL:
Implement a
Next Generation Audio
broadcast chain using
ADM on a live event

What is Next Generation Audio?

What NGA technology is there?

The scope of NGA covers emission codecs.

- Currently available codecs:
 - **MPEG-H** (Fraunhofer)
 - **AC-4** (Dolby)
 - **DTS-UHD** (Xperi)
- Increasing support in consumer devices

What is Next Generation Audio?

NGA codecs have big differences!

- Bitstreams incompatible with each other
- Number of channels available
- The ability of reconfigure
- The level of interaction available
- The coordinate systems used:
 - Cartesian allocentric v. Spherical egocentric

We need some common ground!

What is the Audio Definition Model (ADM)?

The common ground for audio metadata

Purposes:

- A free, open-standard (ITU-R BS.2076)
- Covers production, distribution, up to emission
- Codec-agnostic
- Flexible and versatile
- Simple representation

Why use it?

- Enables exchange of content & playout across different mediums/platforms
- Avoids locking in to one vendor eco-system
- Future-proofing of content

What is S-ADM?

Serial ADM – for live and real-time applications

- ADM is primarily for file-based non-live delivery
- S-ADM segments the ADM metadata into frames
- Can be carried over different types of transport:
 - SMPTE **ST337** & **ST2116** – over AES3 and MADI
 - SMPTE **ST2110-31** & **ST2110-41** – over IP

What is ADM-OSC?

For real-time production control

- **Based on Open Sound Control**
- Not standardised (yet)
- Lots of interest from software and console manufacturers
- Current version only provides object parameters
 - Does not describe programme structure

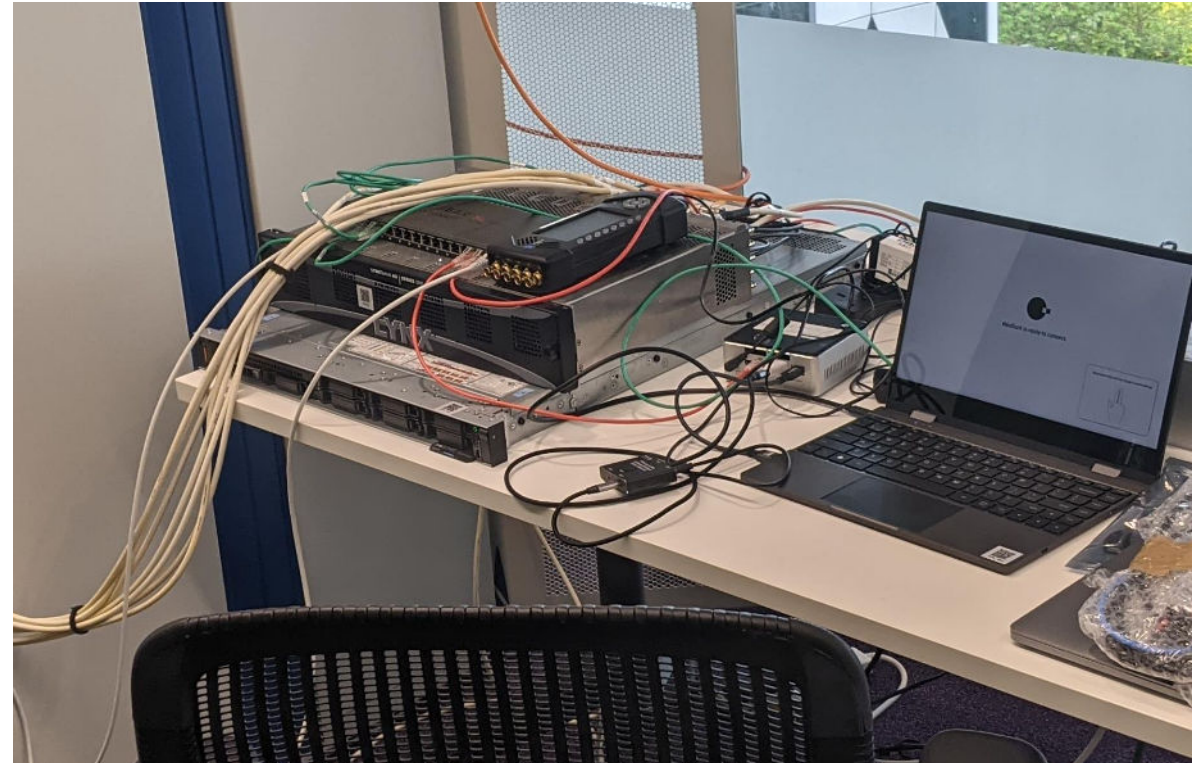
The Setup

Trial Partners

Dolby

NGA Emission

- Encoder running on an Ateame Titan
 - Expects Video + Audio + S-ADM over SDI
- Sent to DASH Server
- Also Sent via DVB-T Modulator
- Smartphone App and TV with AC-4

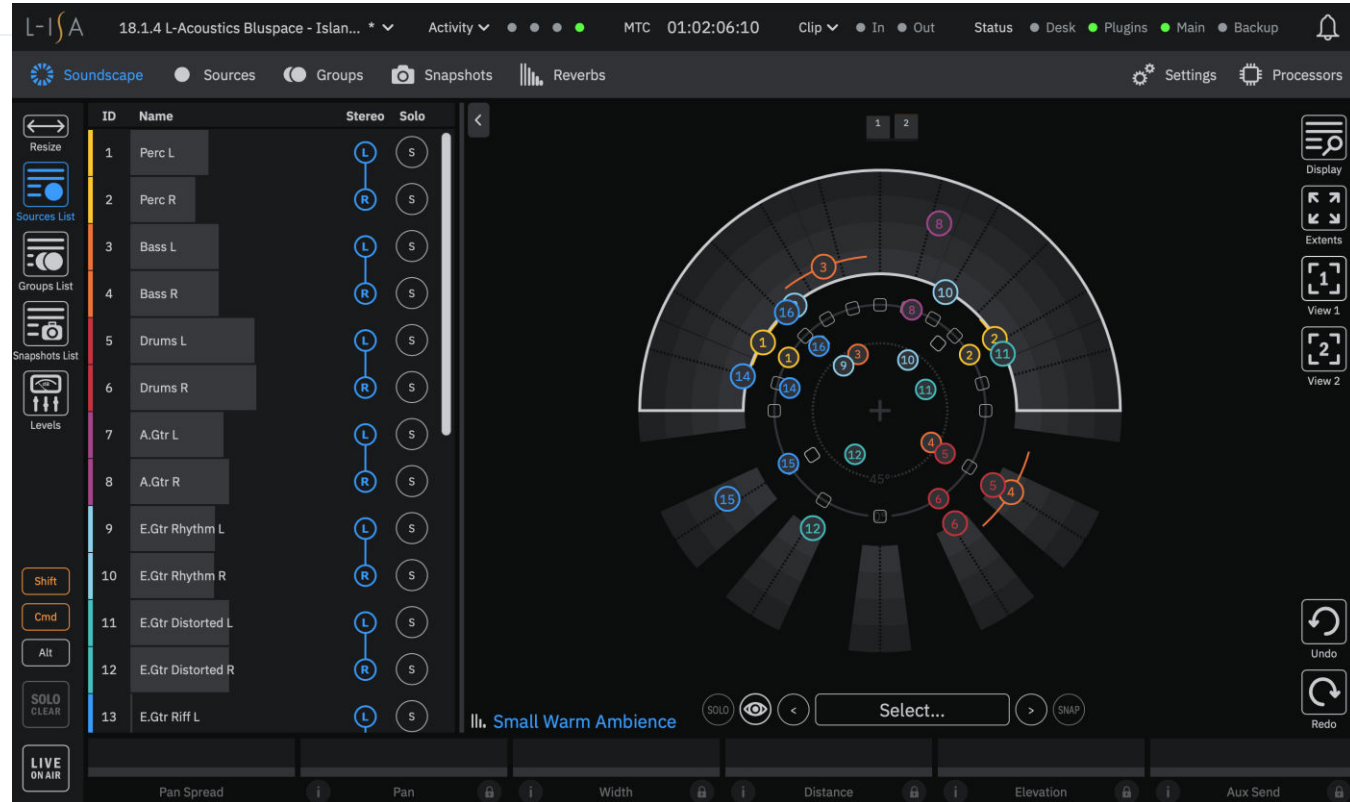


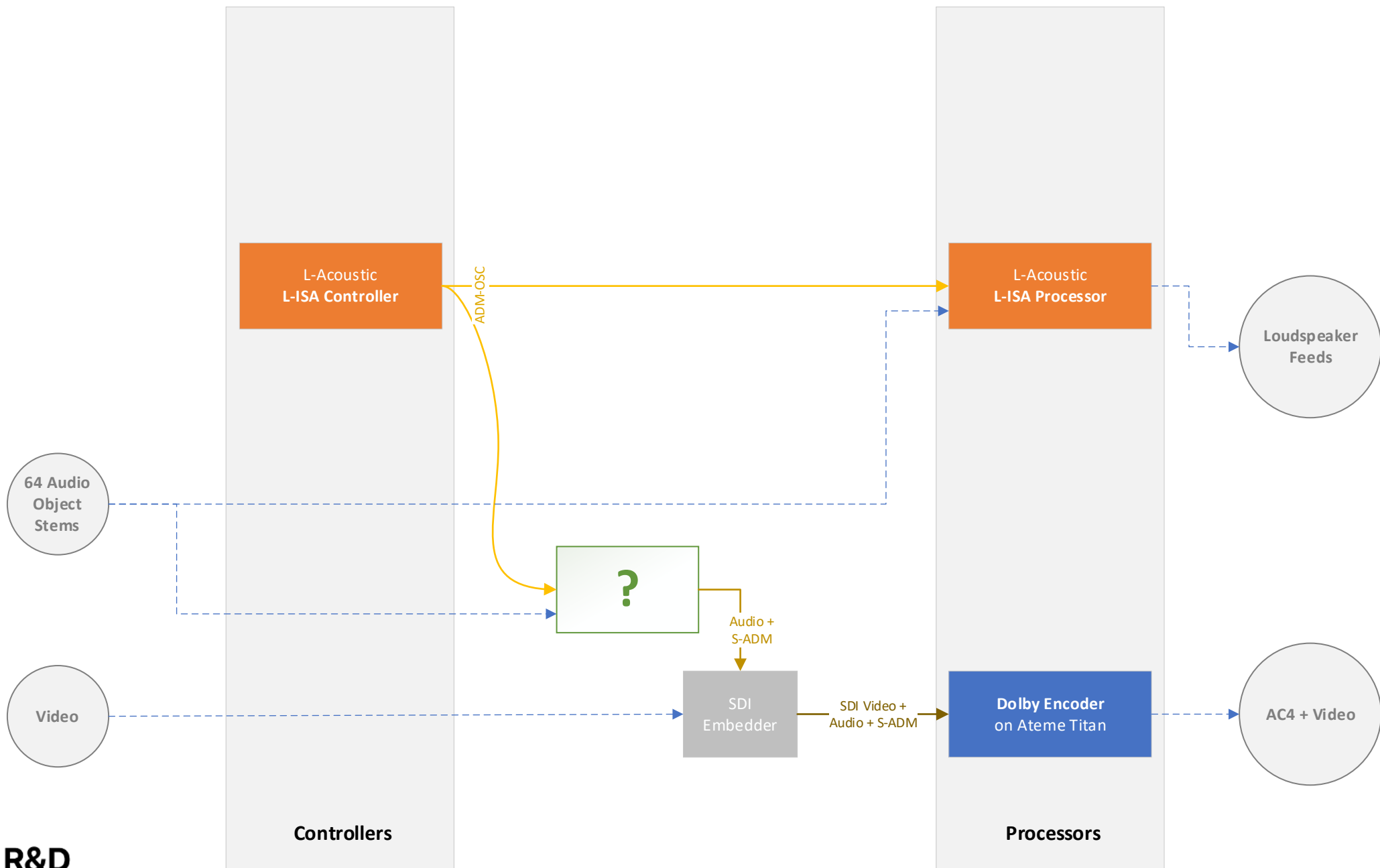
Trial Partners

L-Acoustics

Spatial Audio Live Production

- **L-ISA**
 - **Controller** – can emit ADM-OSC
 - **Processor** – rendering to any speaker layout





BBC R&D Software

Filling the Gap

- **ADM-OSC to S-ADM**
- **“Squeezing”**
 - <64ch down to 15ch
 - Conforming metadata
- **Compression**
- **ST337 encoding (according to ST2116)**

Channel Allocation

From mixing desk

Channel Numbers	Content	Format
1-6	Full Pres	5.1
7-8	Full Pres	Stereo
8-14	VTs	5.1
15-20	Grams	5.1
21-22	Stage	Stereo
23-28	Audience Post	5.1
29-30	OS	Stereo
31-32	Music	Stereo
33-38	Soundfield	5.1
39-58	Audience	20x mono
59	TV Comm	Mono
60	Radio Comm	Mono
61	TV Comm BU	Mono
62	Radio Comm BU	Mono

Channel Allocation

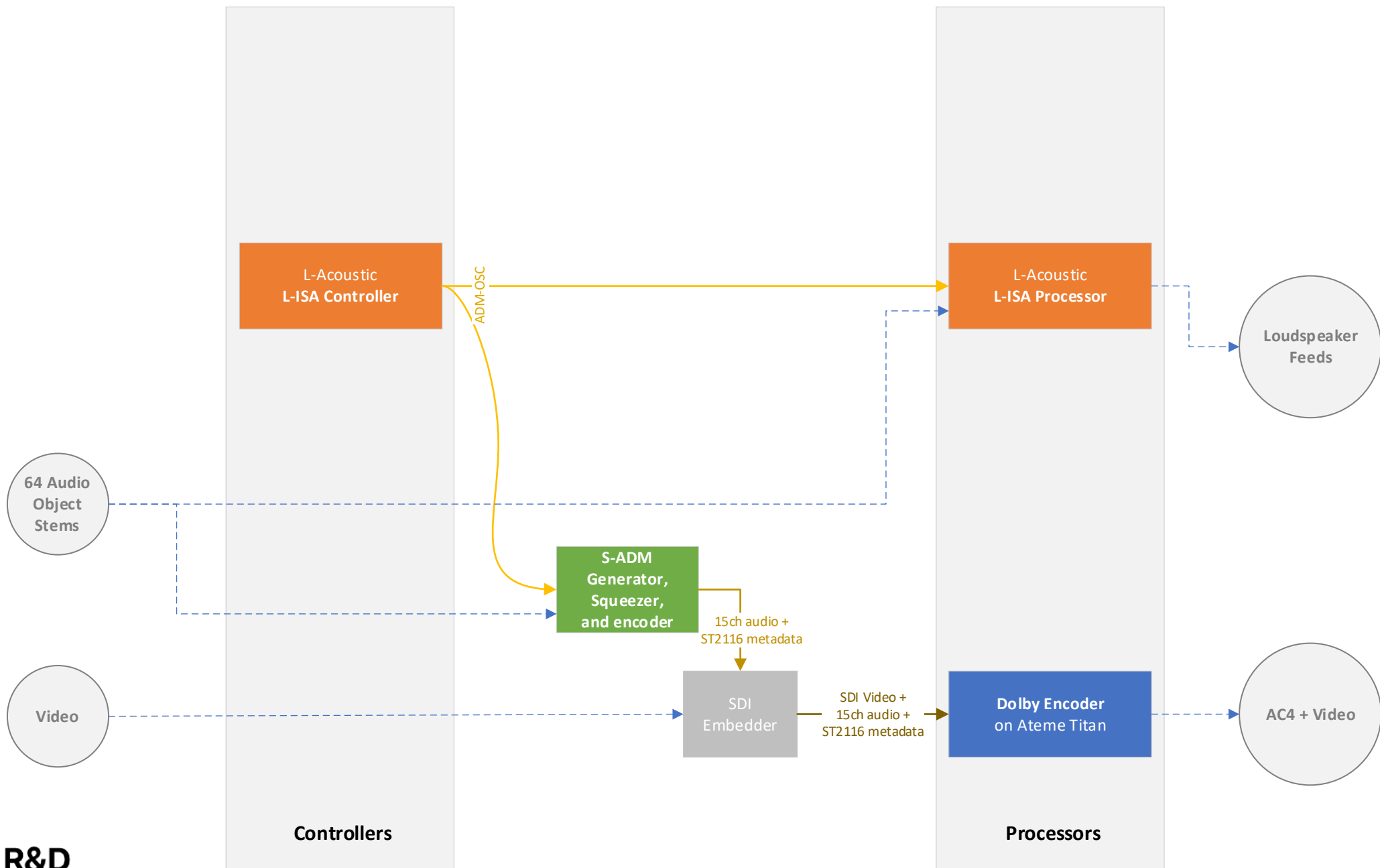
Squeezed channels

Channel Numbers	Content	Format
1-6	Full Pres	5.1
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4+5+0 (5.1.4)
Channel-based downmix

Mono Object

Mono Object



BBC R&D Software

Alternative Controller

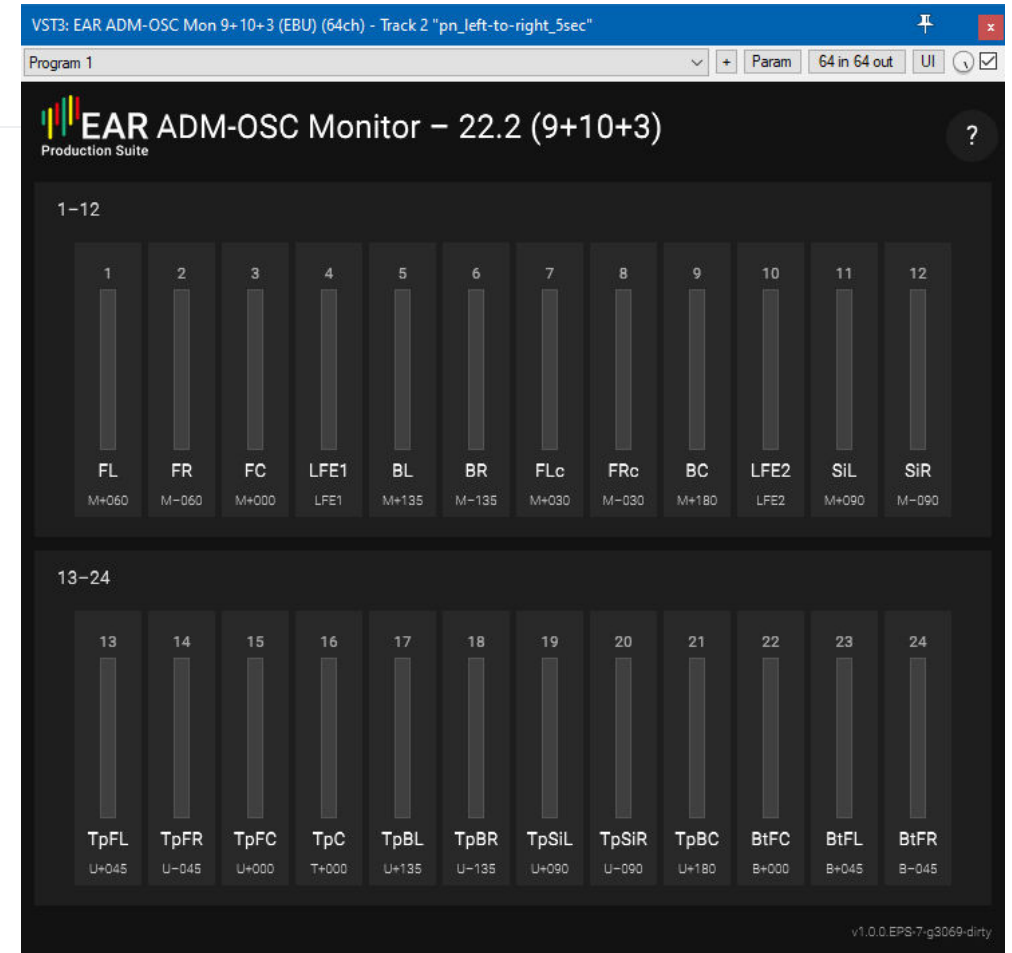
- Live Binaural Production Tool
- Already object-based in concept
- Already used OSC
- Adapted to output ADM-OSC

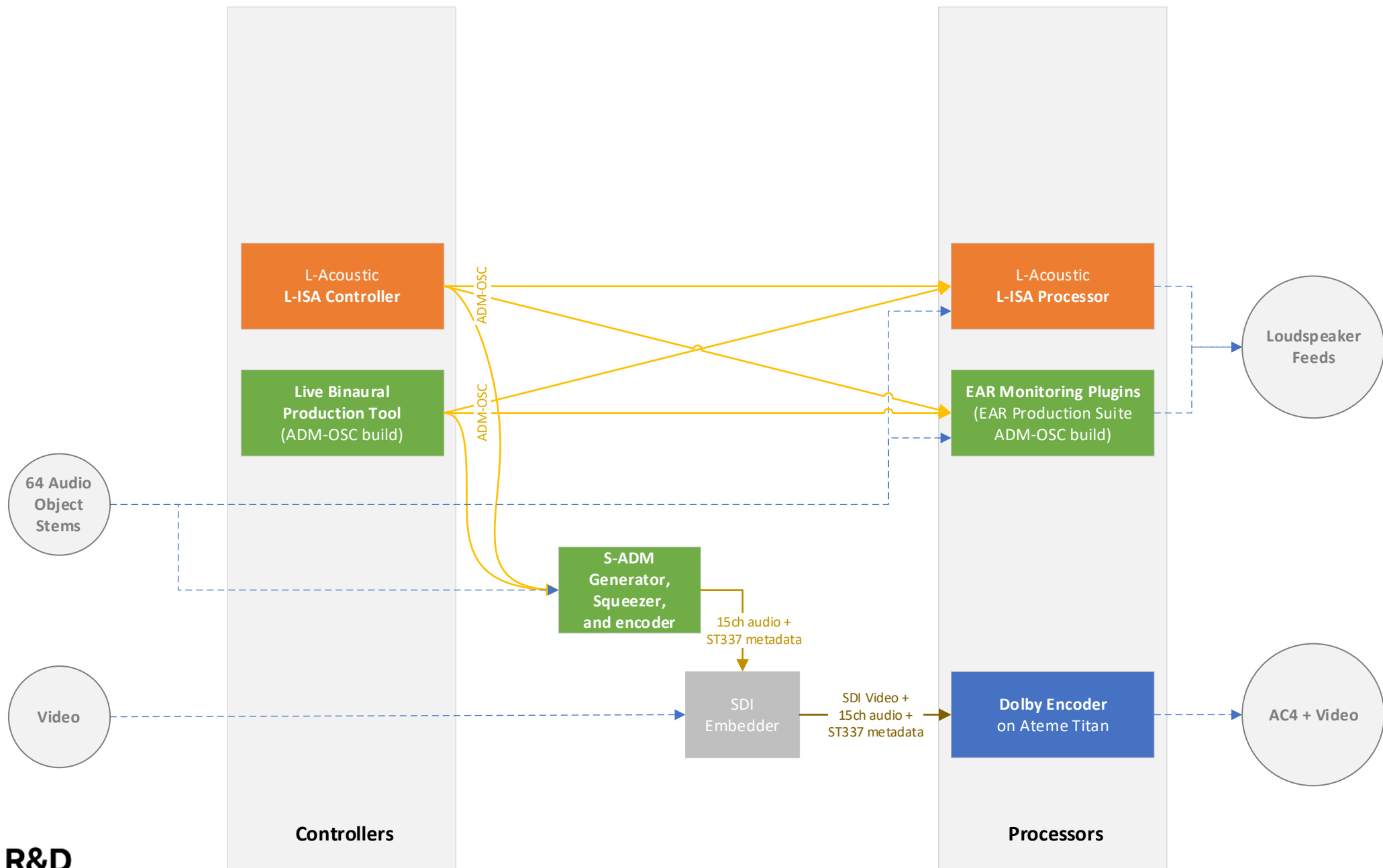


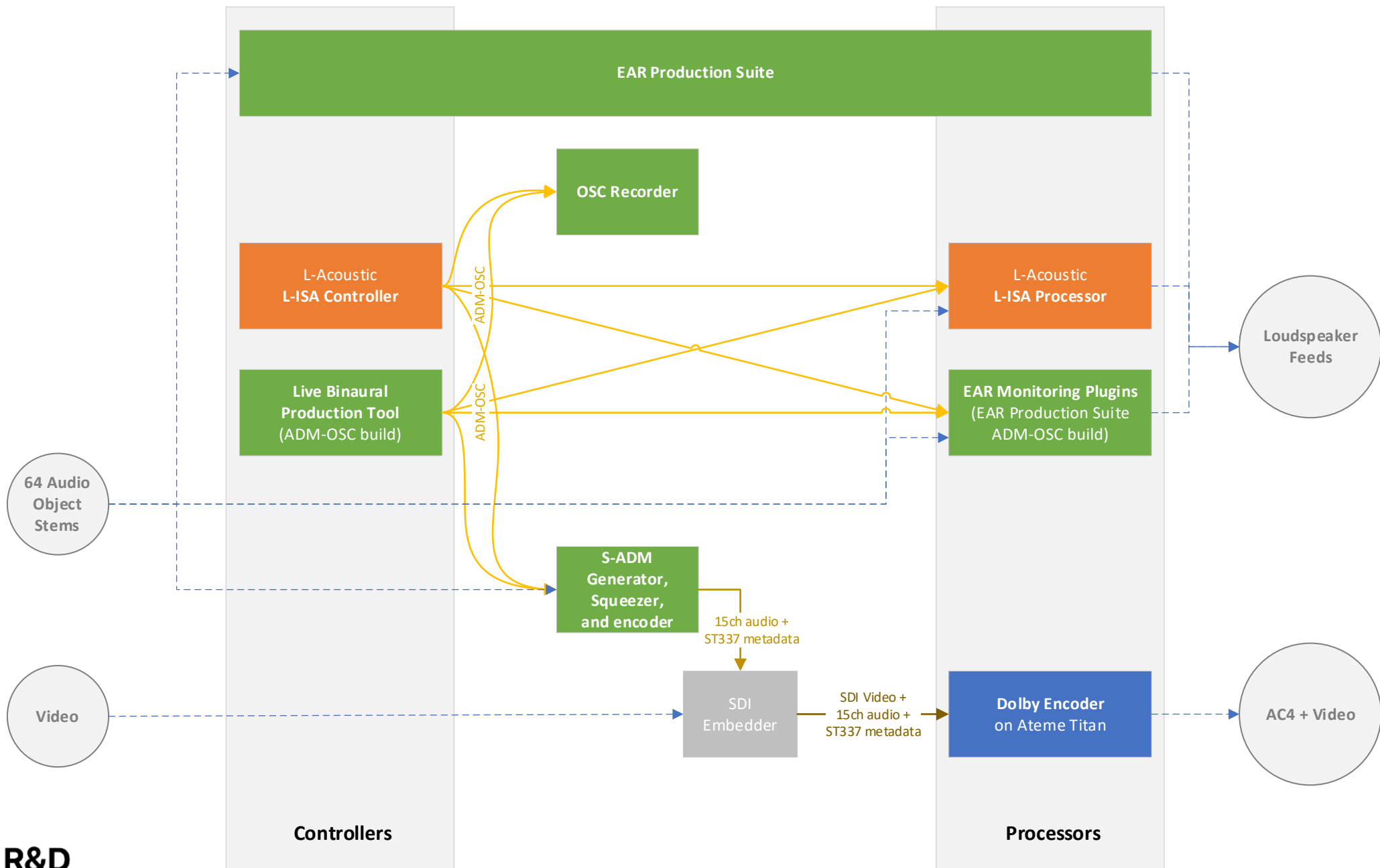
BBC R&D Software

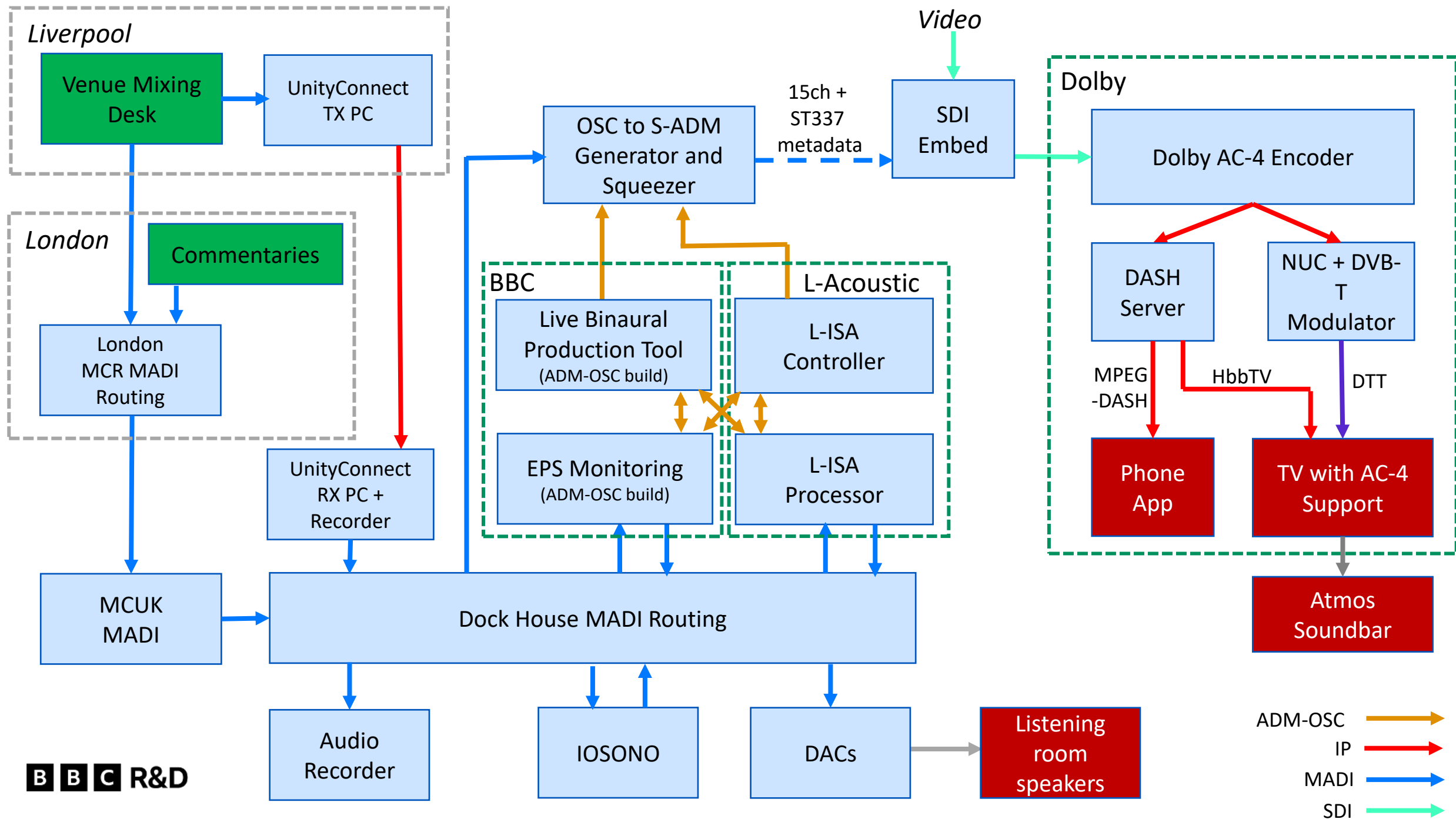
Alternative Processor

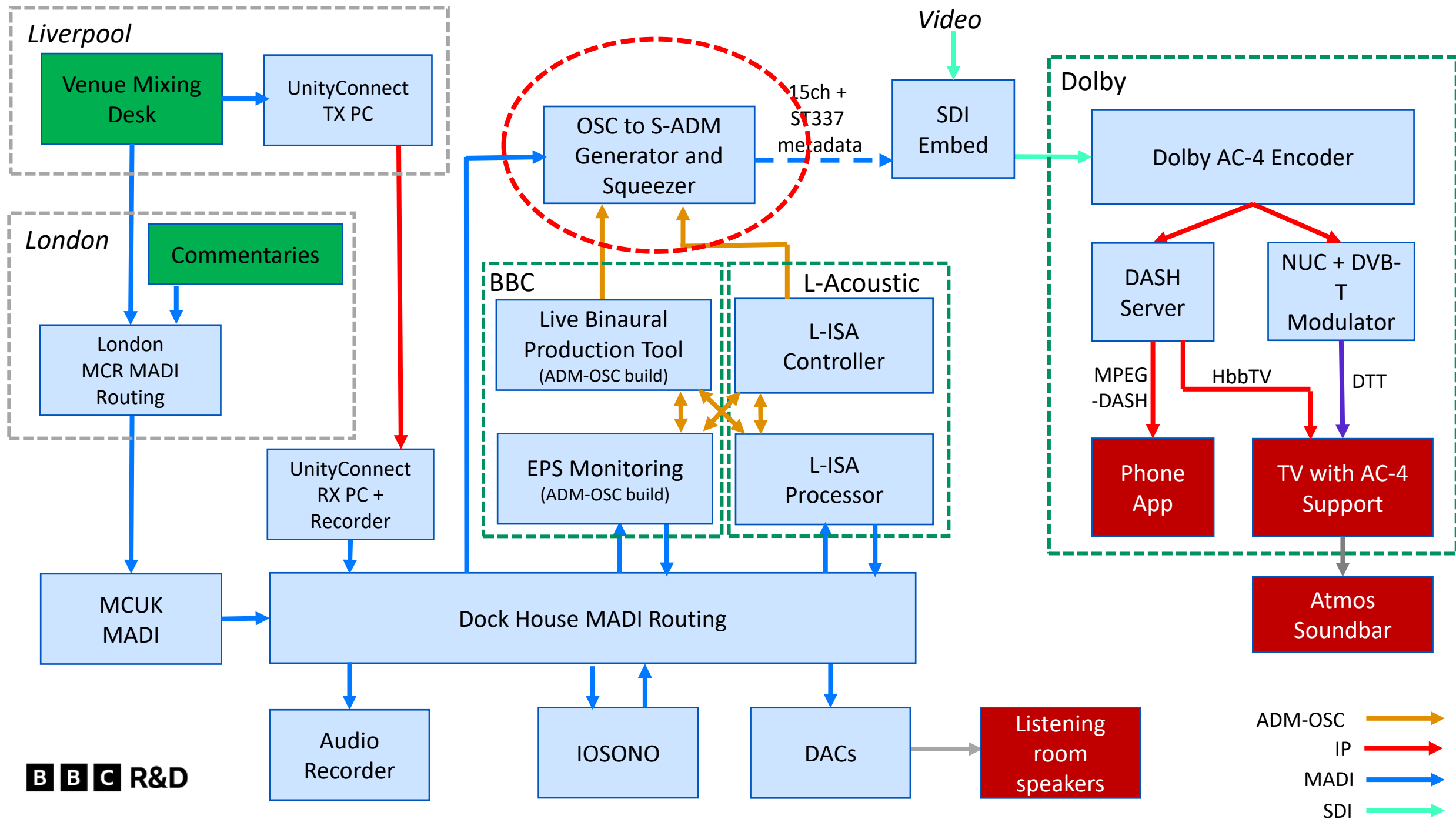
- Using EAR
 - EBU ADM Renderer
 - Based on ITU-R BS.2127
- Adapted the EAR Production Suite monitoring plugins



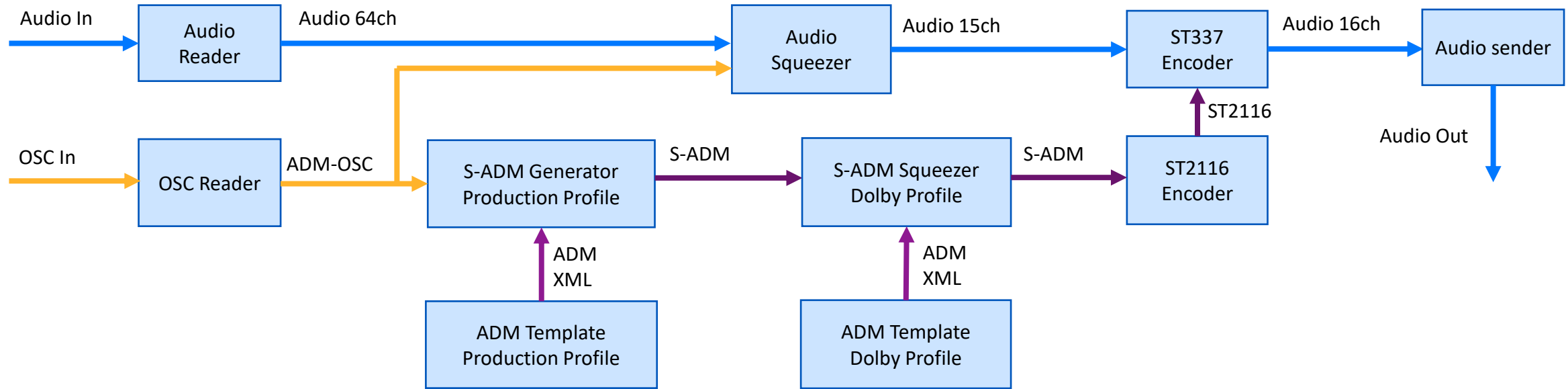




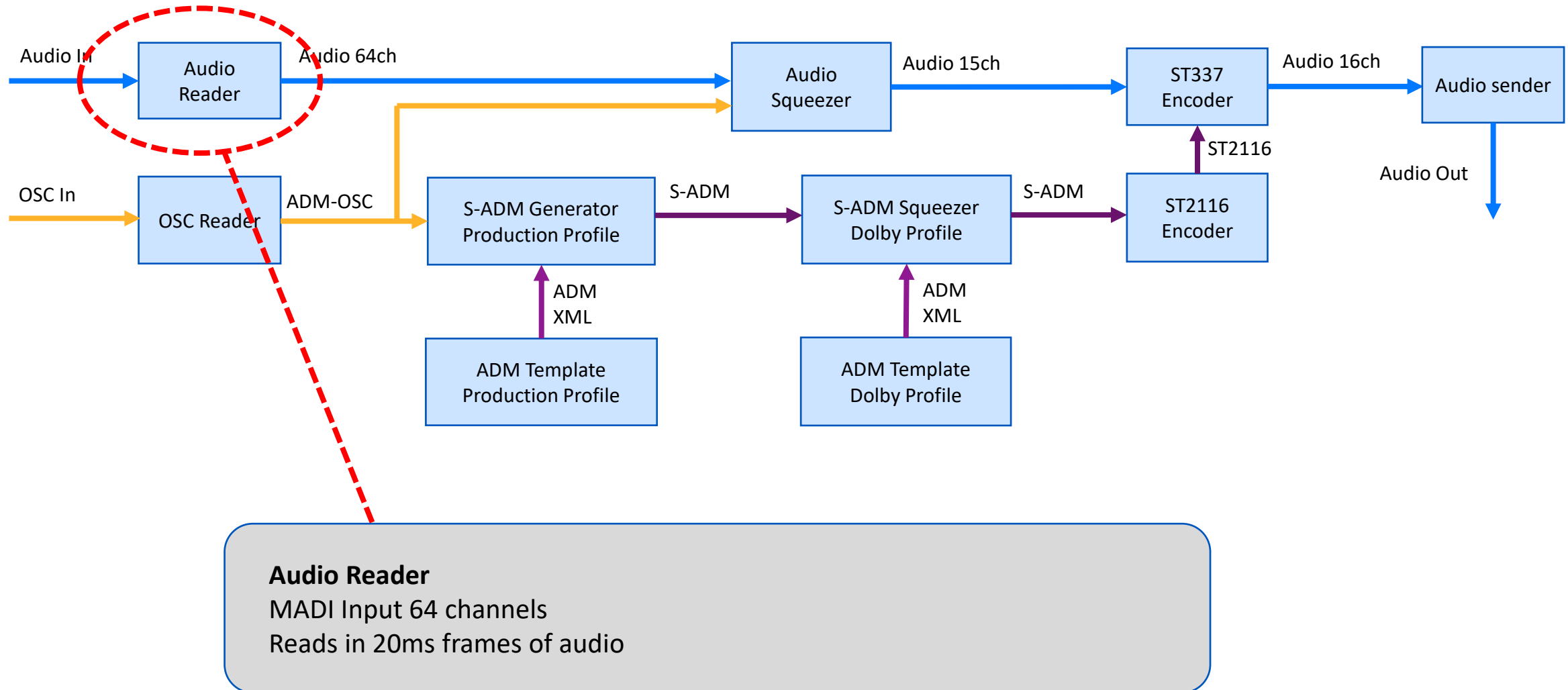




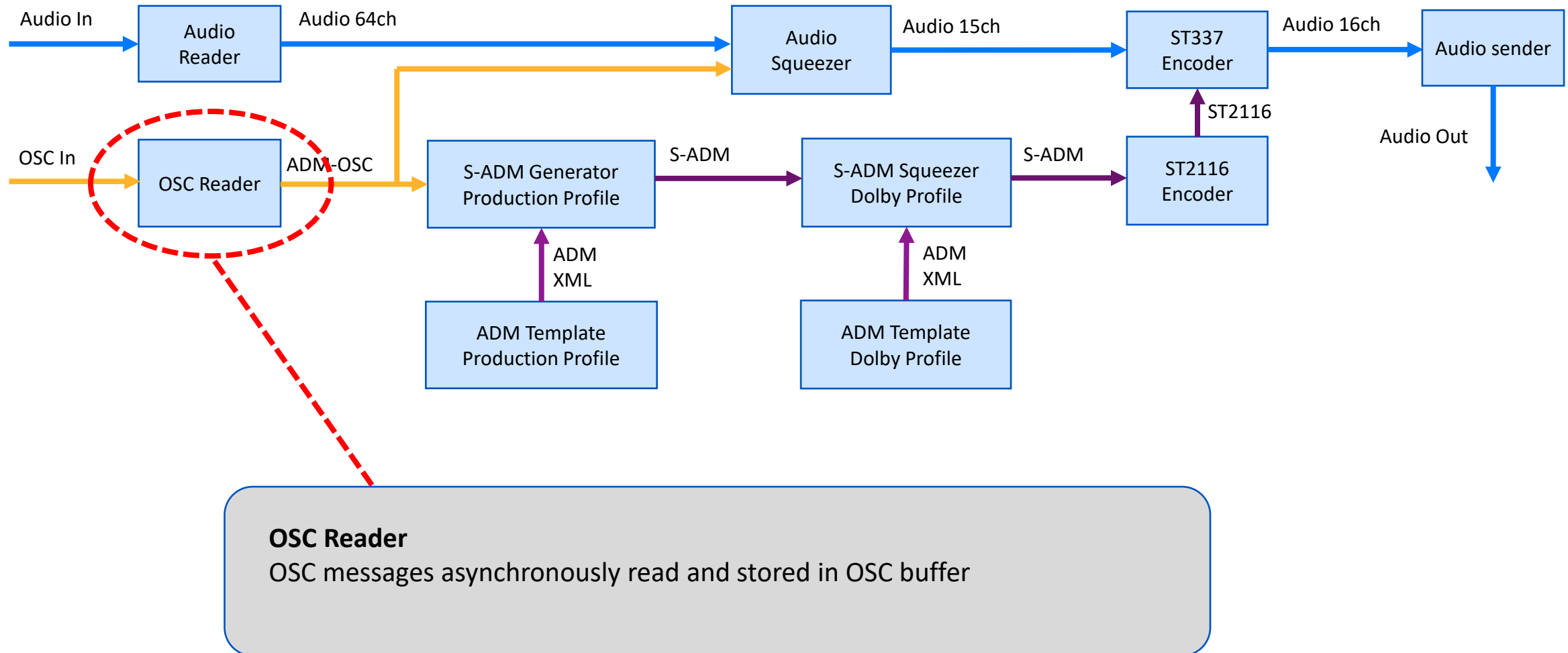
S-ADM Generator



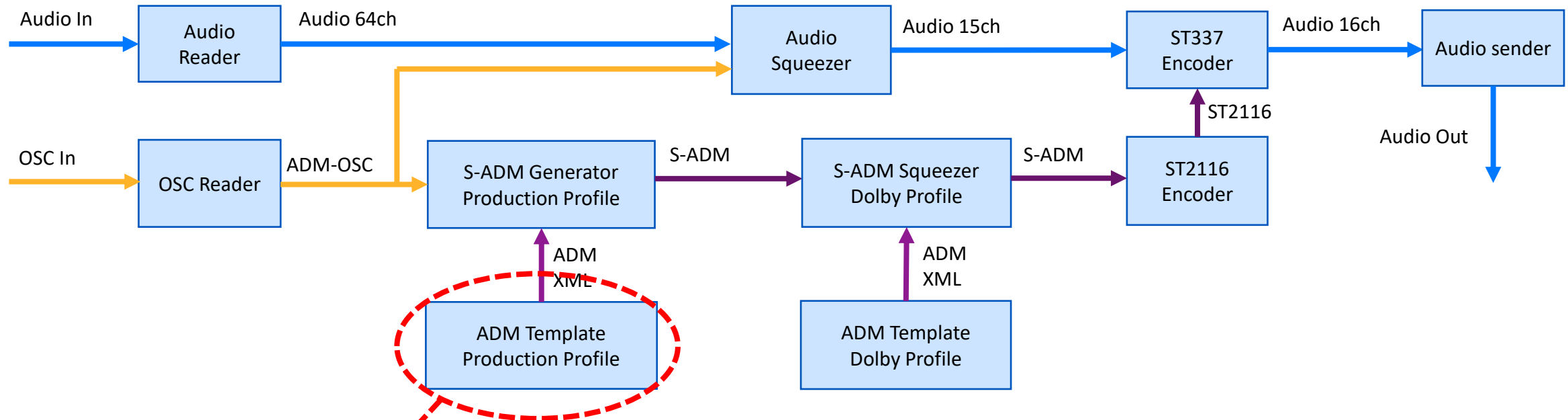
S-ADM Generator



S-ADM Generator



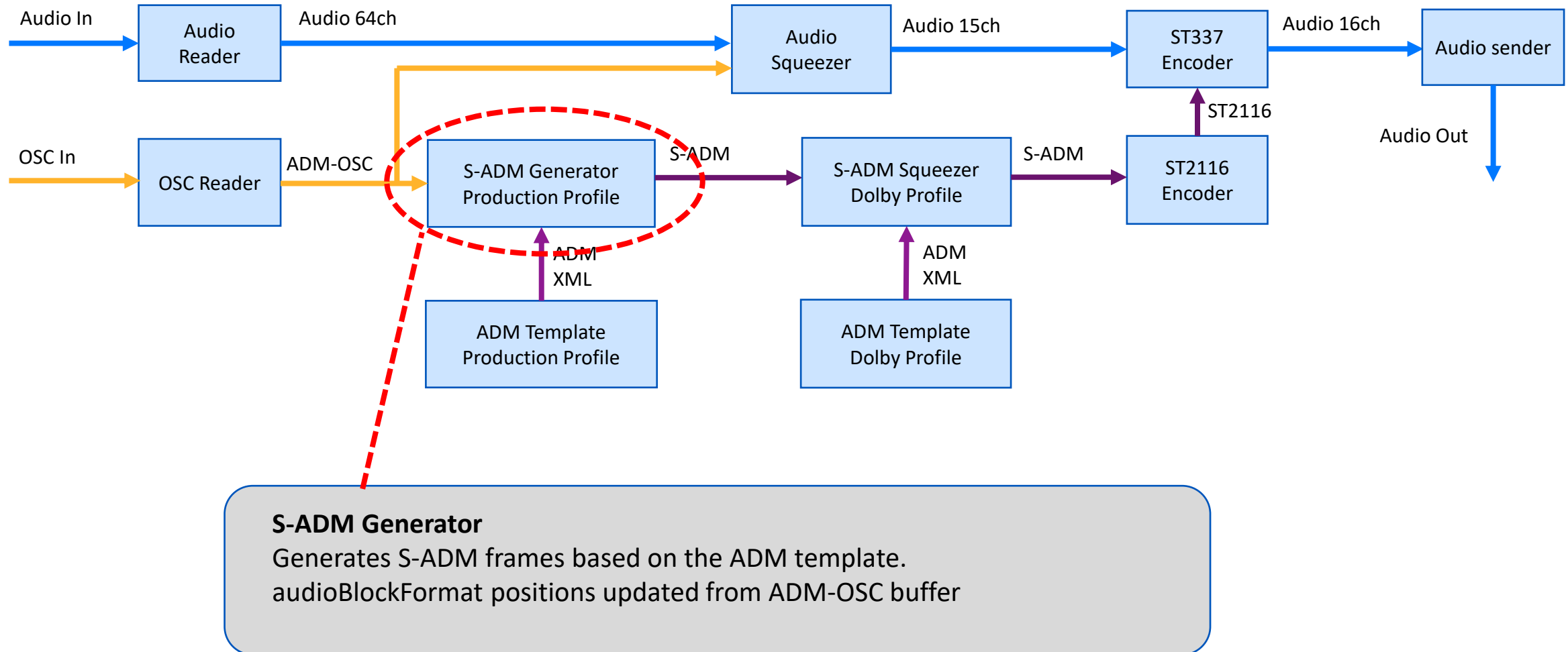
S-ADM Generator



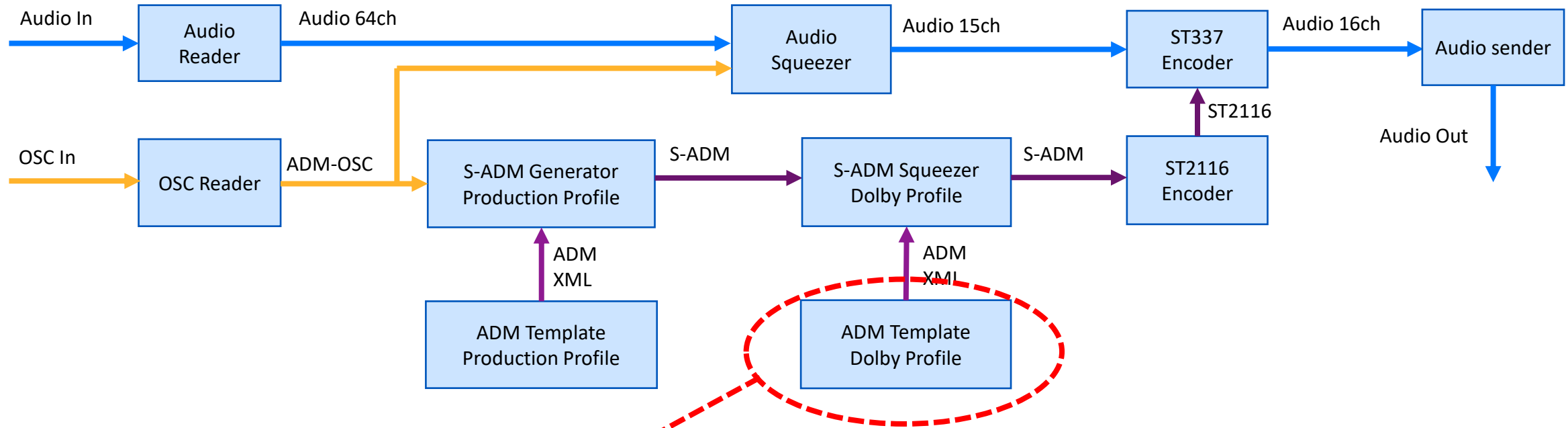
ADM Template – Production Profile

ADM file to act as template for this production
Spaces left for S-ADM generator to populate
Sent as a one-off ADM XML to generator

S-ADM Generator



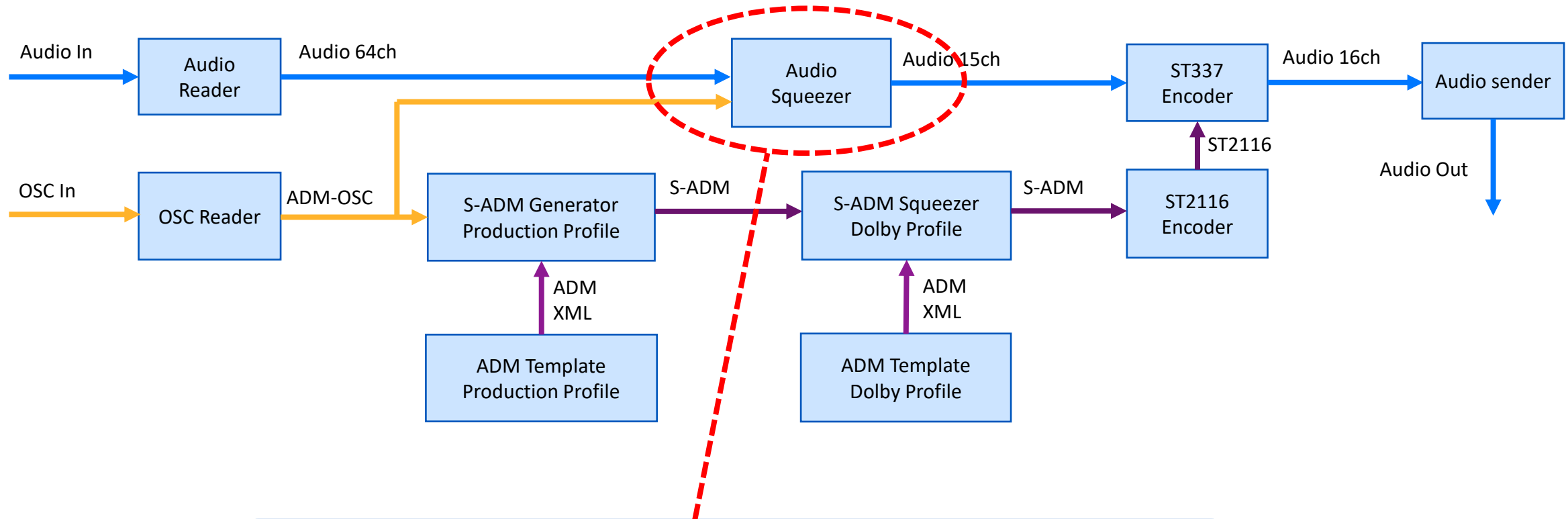
S-ADM Generator



ADM Template – Dolby Profile

ADM file to act as template for this production
Spaces left for S-ADM squeezer to populate
Sent as a one-off ADM XML to generator

S-ADM Generator



Audio Squeezer

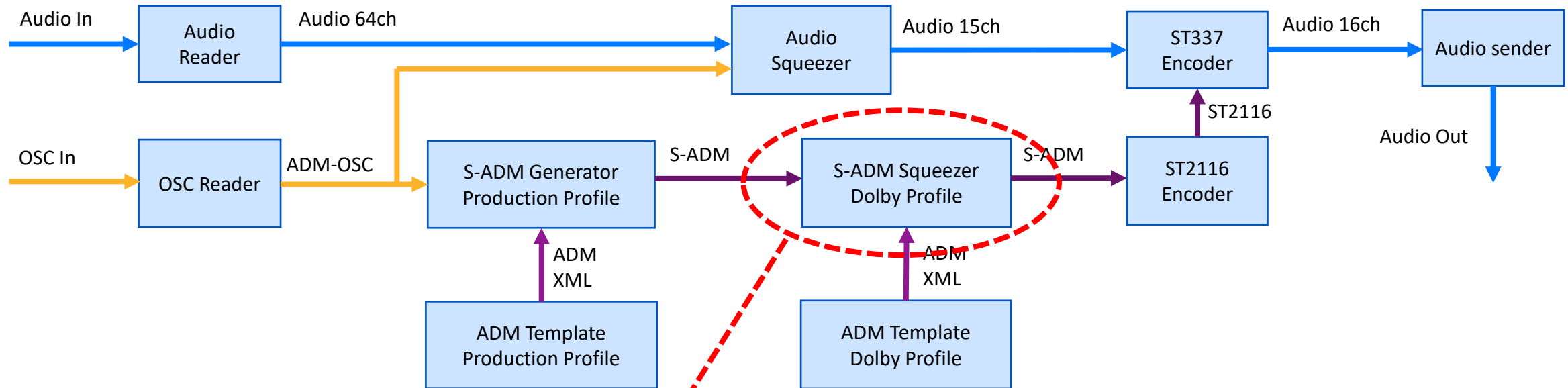
Converts audio from 64 channel (46 actually used) to 15 channels.

Bespoke mixing for ESC setup.

Commentary channels kept separator.

Gains of input channels adjusted in real-time from ADM-OSC messages

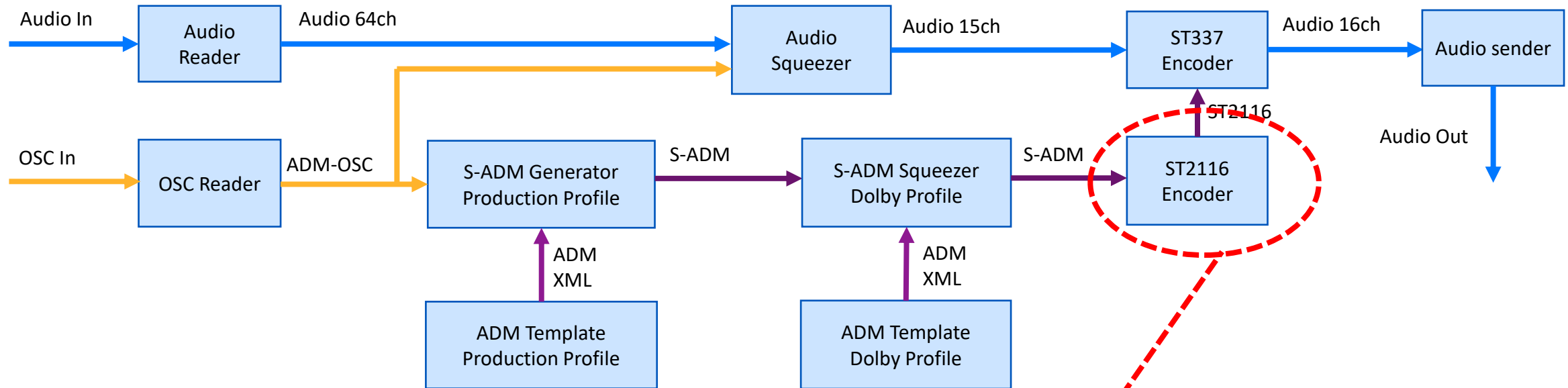
S-ADM Generator



S-ADM Squeezer – Dolby Profile

For the purposes of the ESC trial this was bespoke code to generate Dolby-style ADM
Generates S-ADM based on ADM template
Some real-time positional data is preserved from production profile S-ADM

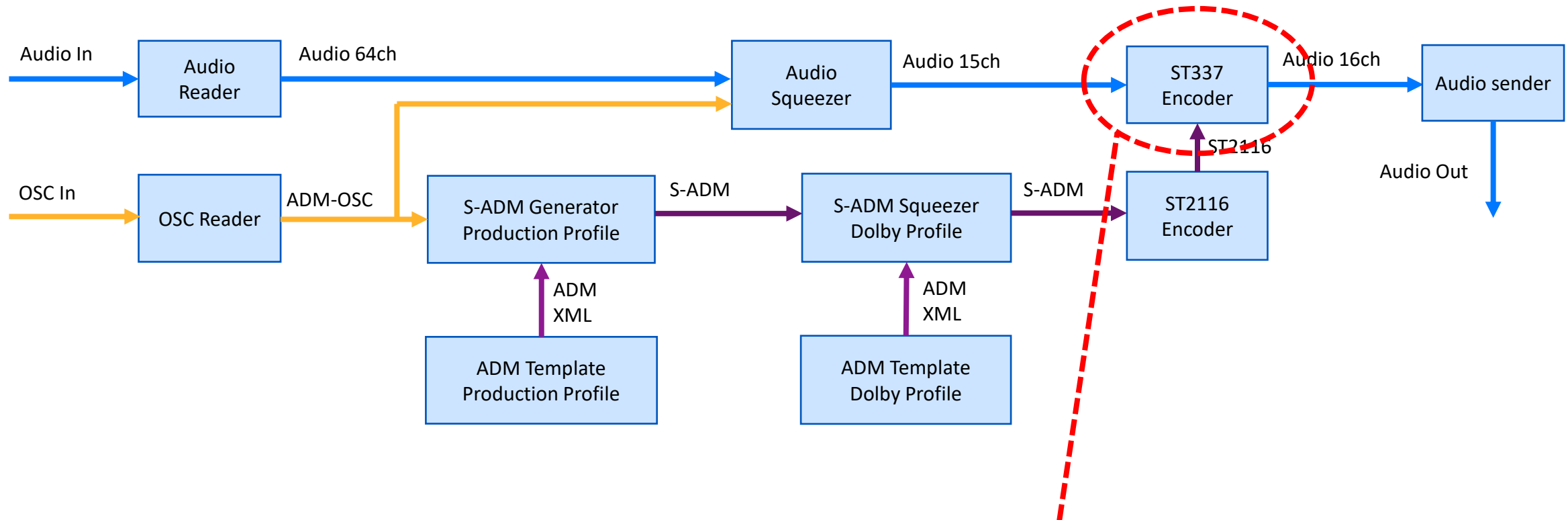
S-ADM Generator



ST2116 Encoder

Converts S-ADM XML Frame to SMPTE ST2116 format
XML data is gzipped to keep within 960 byte frame size limit

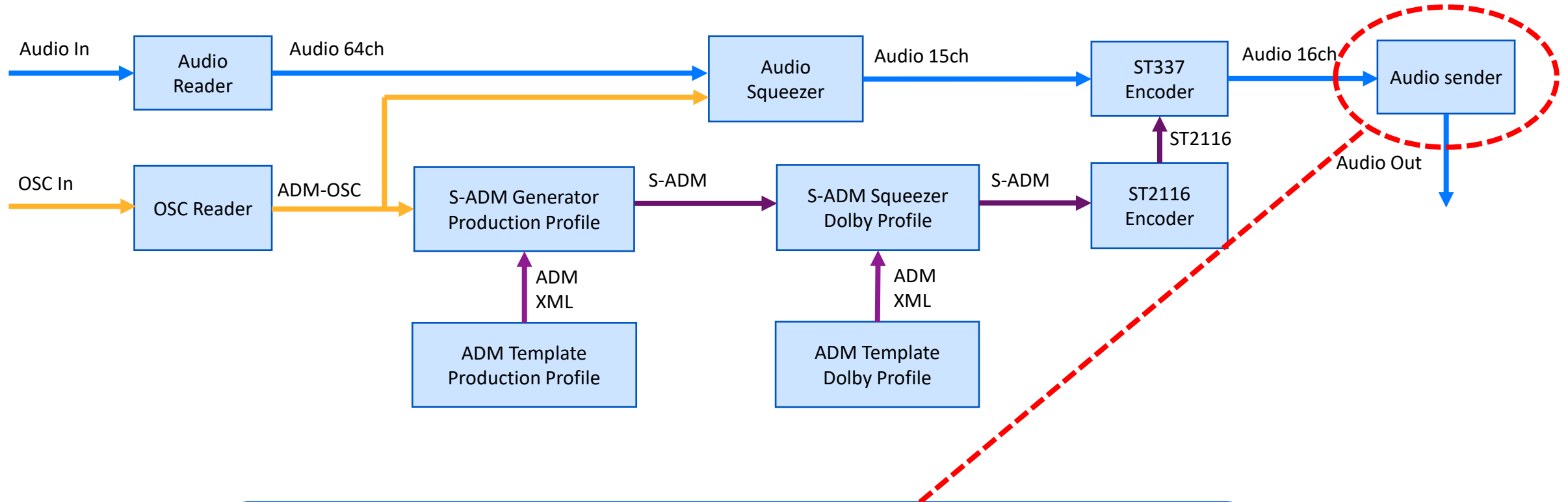
S-ADM Generator



ST337 Encoder

Adds S-ADM ST2116 encoded data to SMPTE ST337 data structure.
S-ADM data is carried as non-PCM data in 16th channel
Channels 1-15 carry the PCM audio data

S-ADM Generator

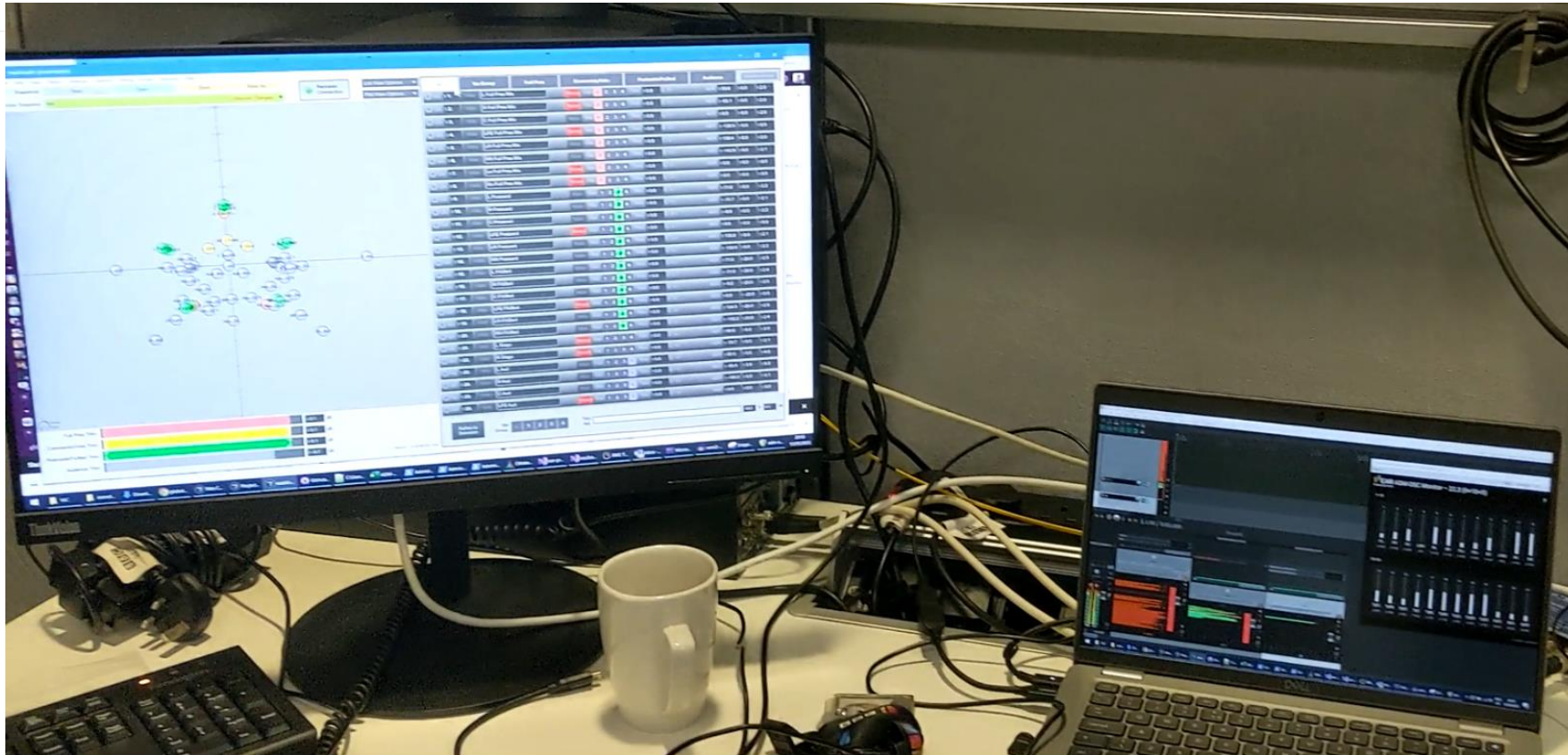


Audio Sender

16 channels of audio (15 audio channels + 1 S-ADM data channel)
Sent out over MADI.

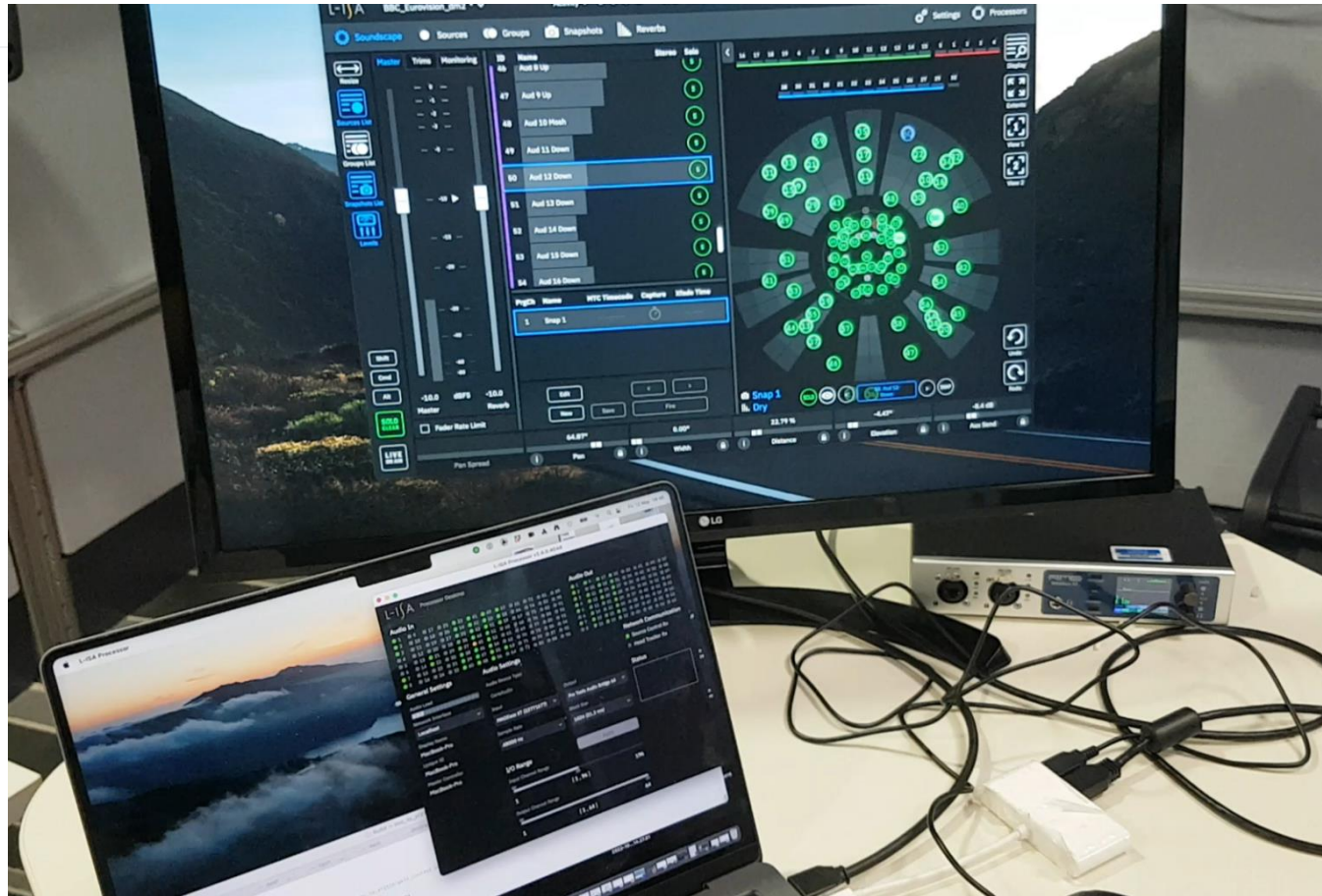
The Trial

Live Binaural Production Tool and EAR



The Trial

L-ISA and S-ADM Generator/Squeezer



Next Steps

- **Generalising;**
 - our ADM-OSC to S-ADM converter
 - our squeezing software
- **Build up to IP-based protocols**
- **Standardise a common Emission Profile and a Production Profile**
 - Consider how we convert from production to emission profile and emission profile to codecs

Thanks!