Embedded Channel Layout Information in 1722a AVTP Frames

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Problem Overview

- When transmitting audio content from entertainment media (e.g. DVD) via AVB, the channel layout can change anytime, e.g. from stereo to 5.1 multichannel
- Typically, the source does not provide the layout change information in advance, but at the same time it delivers the first audio samples to which the new layout applies
- In order to reconfigure the audio processing on sink side accordingly, the exact data frame needs to be known from which on the new layout is valid
- The channel layout should be transmitted along with the audio frames

Approach

- CEA 816 enumerates the channel layouts that can be found on entertainment media
- Defines eight-bit code to identify these layouts
- The code is useful not only in the context of CEA 816 – why invent the same thing twice?

Speaker Layout

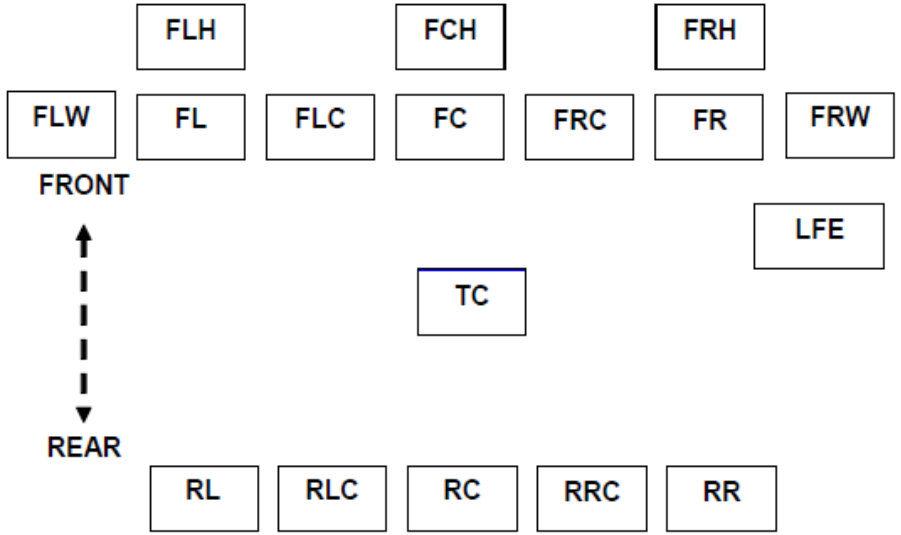


Figure 6 Speaker Placement

Label	Location
FL	Front Left
FC	Front Center
FR	Front Right
FLC	Front Left Center
FRC	Front Right Center
RL	Rear Left
RC	Rear Center
RR	Rear Right
RLC	Rear Left Center
RRC	Rear Right Center
LFE	Low Frequency Effect
FLW	Front Left Wide
FRW	Front Right Wide
FLH	Front Left High
FCH	Front Center High
FRH	Front Right High
TC	Top Center

Table 27 Speaker Placement

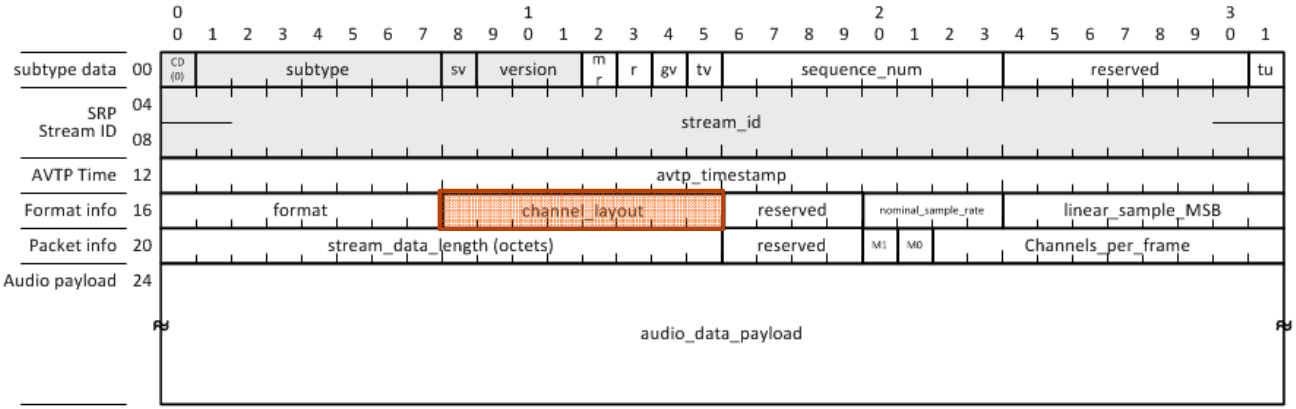
Channel Layout Coding

CA (binary)								CA (hex)	Channel Number							
7	6	5	4	3	2	1	0		8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0	0x00	-	-	-	-	-	-	FR	FL
0	0	0	0	0	0	0	1	0x01	-	-	-	-	-	LFE	FR	FL
0	0	0	0	0	0	1	0	0x02	-	-	-	-	FC	-	FR	FL
0	0	0	0	0	0	1	1	0x03	-	-	-	-	FC	LFE	FR	FL
0	0	0	0	0	1	0	0	0x04	-	-	-	RC	-	-	FR	FL
0	0	0	0	0	1	0	1	0x05	-	-	-	RC	-	LFE	FR	FL
0	0	0	0	0	1	1	0	0x06	-	-	-	RC	FC	-	FR	FL
0	0	0	0	0	1	1	1	0x07	-	-	-	RC	FC	LFE	FR	FL
0	0	0	0	1	0	0	0	0x08	-	-	RR	RL	-	-	FR	FL
0	0	0	0	1	0	0	1	0x09	-	-	RR	RL	-	LFE	FR	FL
0	0	0	0	1	0	1	0	0x0A	-	-	RR	RL	FC	-	FR	FL
0	0	0	0	1	0	1	1	0x0B	-	-	RR	RL	FC	LFE	FR	FL
0	0	1	0	1	1	1	1	0x2F	FRH	FLH	RR	RL	FC	LFE	FR	FL
0	0	1	1	0	0	0	0	0x30	FRW	FLW	RR	RL	FC	-	FR	FL
0	0	1	1	0	0	0	1	0x31	FRW	FLW	RR	RL	FC	LFE	FR	FL
0	0	1	1	0	0	1	0	0x32	Reserved							
...																
1	1	1	1	1	1	1	1	0xFF								

Table 28 Audio InfoFrame Data Byte 4

- Even though more than eight speaker locations are defined, no more than eight channels are used in any of the formats
- Some of the eight audio channels remain unused in some of the layouts
- Should these "empty" channels be transmitted at all?

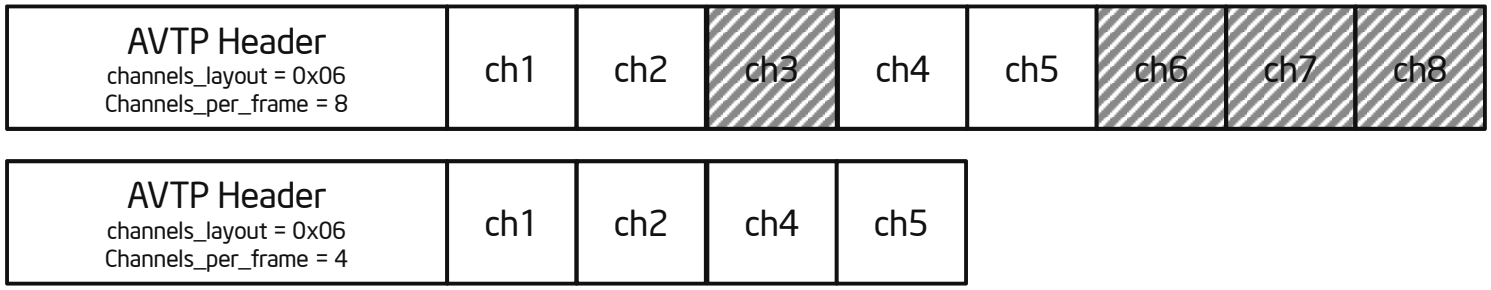
Proposed Amendment



- add reference to CEA-816-E Specification to section 2
- define channel_layout field using eight of the twelve reserved Format info bits
- create new sub-section 8.2.7 channel_layout field
  - defines channel_layout to be coded according to table 28 of the CEA spec
  - defines the behavior with respect to on-the-fly change of layout

Layouts with less than eight channels (1)

- **Example: Layout 0x06 (Front left/right, rear left/right only)**
  - only four out of eight channels carry data
  - should the other four channels be transported at all?



- **The standard would allow both variants, the simple one and the bandwidth-optimized one**
- **Profiles of industry associations could mandate one form for use in a certain context**

Layouts with less than eight channels (2)

- **Feedback from the IEEE1722 WG showed that streams should not change the number of channels per frame during their lifetime, so the used bandwidth remains constant and always matches the reserved bandwidth**
  - A strict mandate if (and if yes, which) header fields are expected to be constant during the lifetime of the stream would deserve its own subsection in the standard and should neither be implied nor should it be hidden in subsections like the proposed new subsection for channel_layout
  - As a consequence, streams that may change channel_layout during operation always have to allocate bandwidth for the maximum of channels (eight)
    - otherwise, the rules for determining which excess channels have been stripped by the talker become too complex
    - The proposed wording (see next slide) should then be appended with the text shown in red color.

Proposed wording

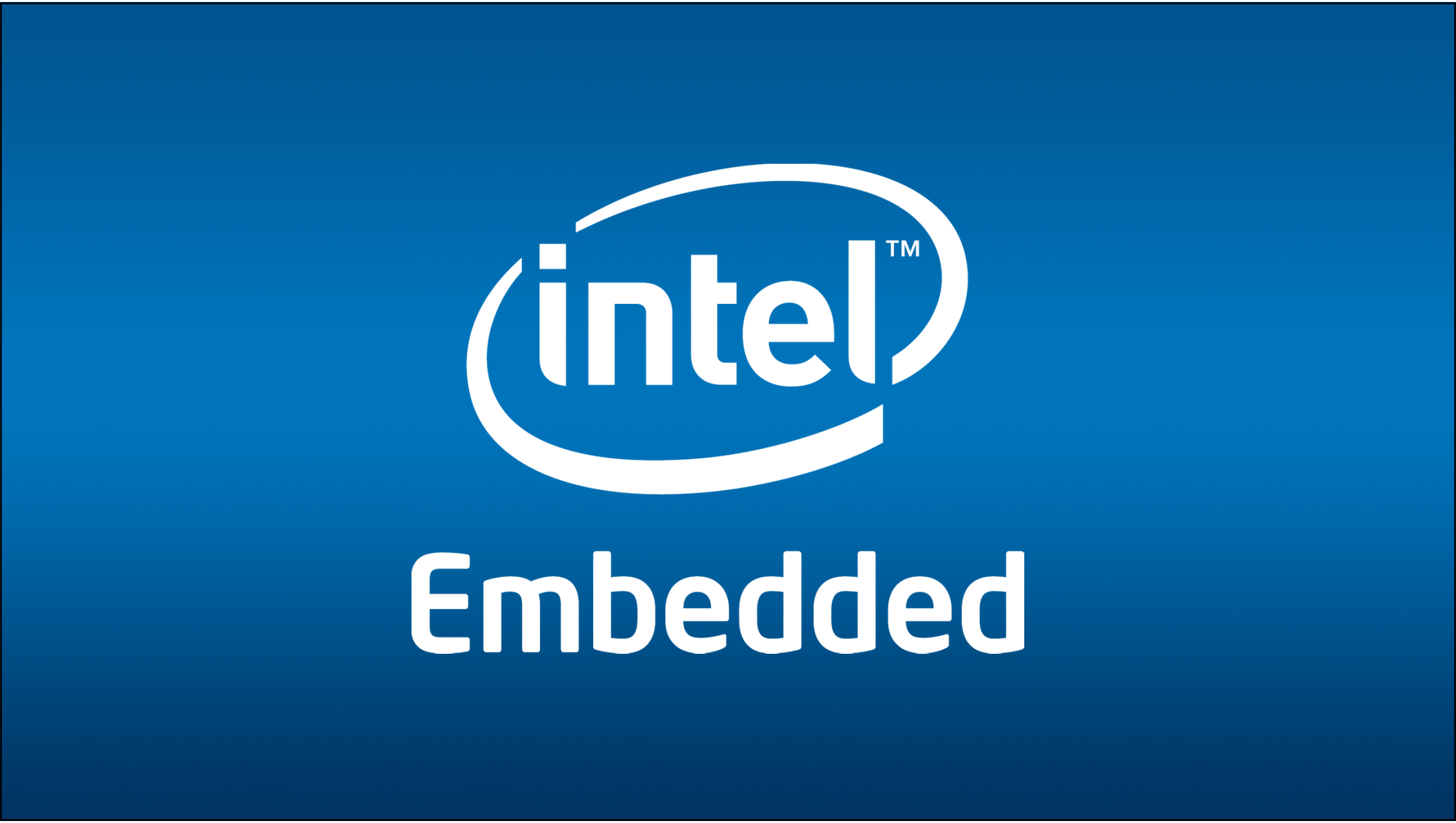
8.2.7 channel_layout field

Channel layout (i.e. channel to speaker mapping).

If the value of channel_layout is in the valid range of values defined in Table 28 of CEA-861-E, the channels in the stream constitute a multi-channel audio signal as defined in the table. The channels_per_frame field shall either be eight (8) or shall be equal to the number of channels that are carrying valid audio data, according to the channel layout. If the value of the channels_per_frame field is eight, and the channel layout indicates that there are less than eight channels with valid audio, the Talker should stream zeros on the invalid channels, and the invalid channels shall be ignored by the Listener. If the value of the channels_per_frame field is equal to the number of valid channels, the Talker shall strip the invalid channels from the AVTPDU and only the channels containing valid data are transmitted.

If the value of channel_layout is 255, the layout of the channels is undefined and needs to be well-known to the Listener for further processing.

The channel_layout applies to all samples of all channels in the AVTPDU. If the layout changes during the lifetime of the stream, the first sample from which on the new layout is valid shall be the first sample in the corresponding AVTPDU. Streams using dynamic change of channel_layout always have to use a channels_per_frame value of eight (8).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