HARMAN

PCM Audio Data Transport Stream adaptation

from an elementary stream to a HDCP-IAA encrypted data flow

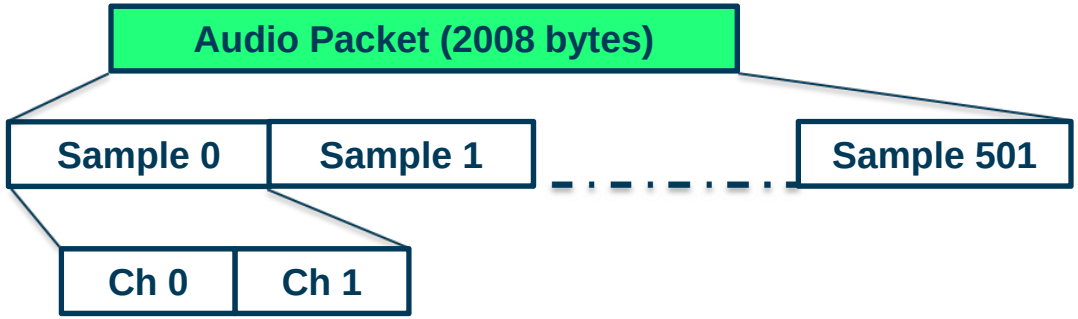
Jochen Klaus-Wagenbrenner / 18.06.2012

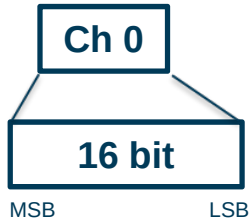
Audio Frame Structure

HARMAN

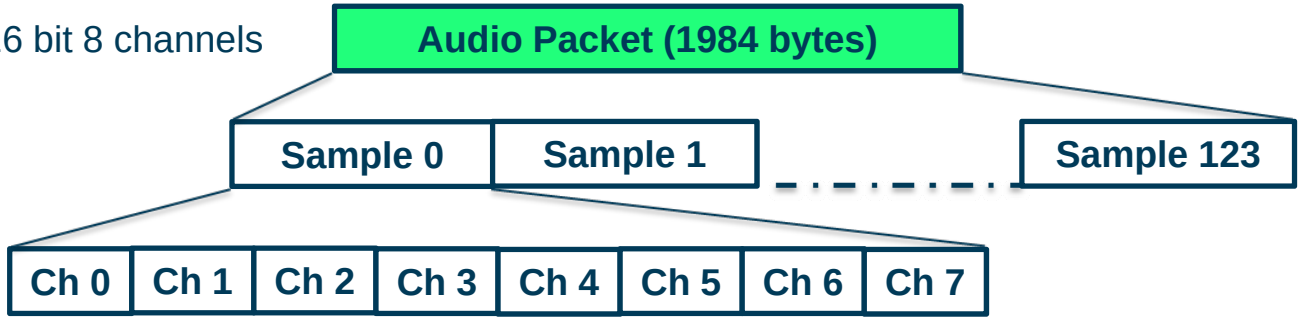
- **Audio sample data alignment**
  - base are 16 bit samples
  - Number of bytes per Audio Packet depends on

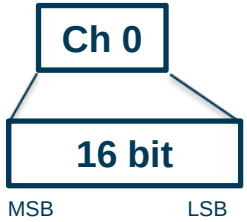
16 bit stereo





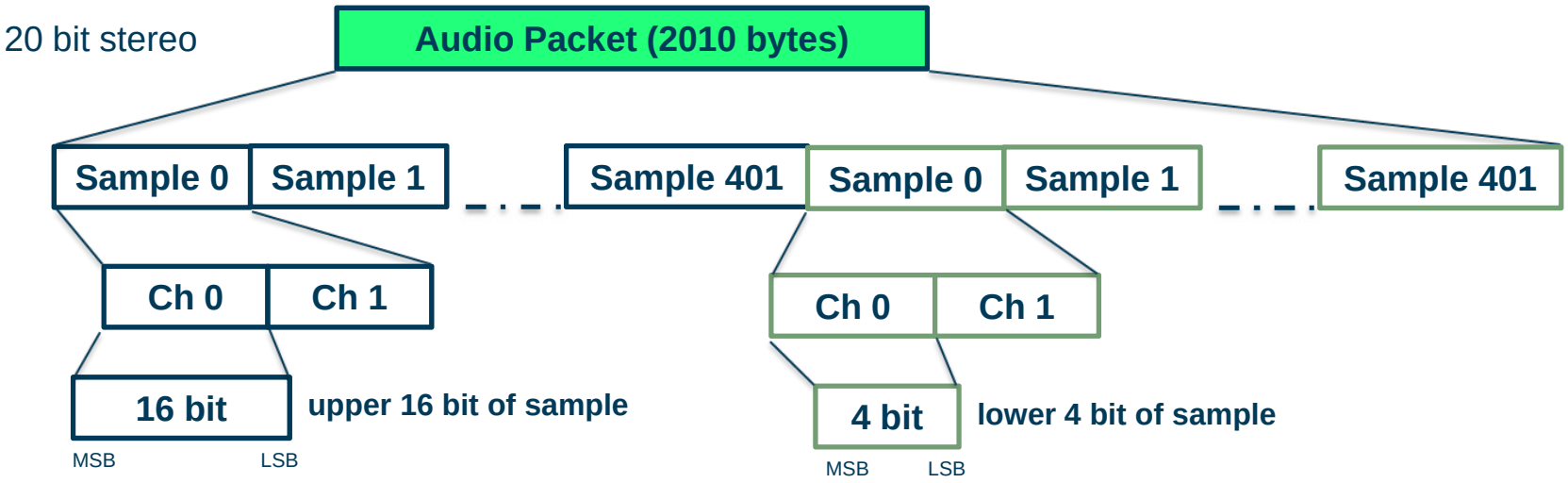
16 bit 8 channels





Audio Frame Structure

- **Audio sample data alignment**
  - for 20 bit, the 4 LSB will be added at the end of a packet



Audio Frame Structure

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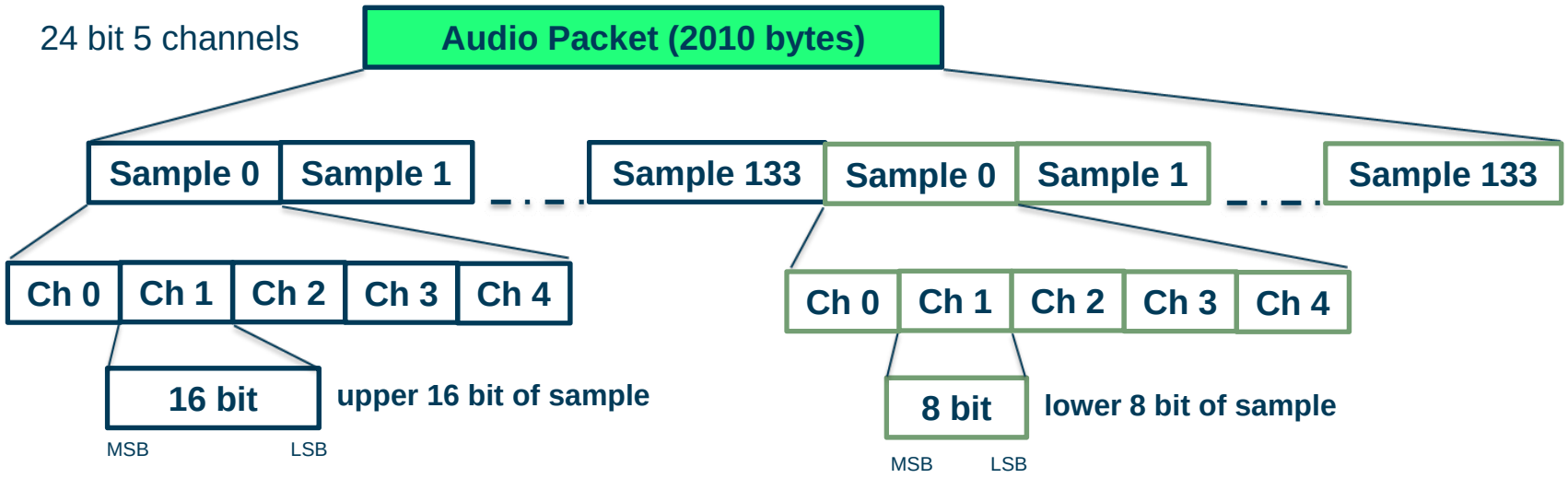
- **Audio sample data alignment**
  - for 24 bit, the 8 LSB will be added at the end of a packet



Packetizing and Transport

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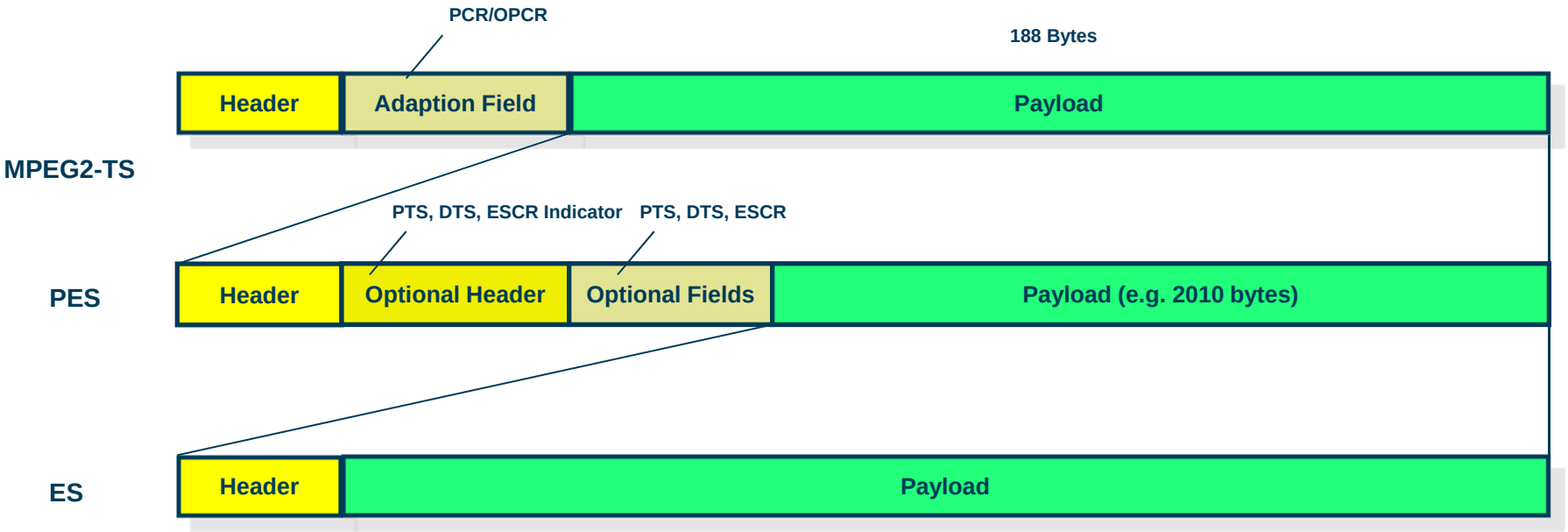
- **Packetizing and Synchronization**
  - PCR/OPCR/PTS/DTS /ESCR



- PCR - Program Clock Reference
- OPCR – Original Program Clock Reference
- PTS - Presentation Time Stamp
- DTS - Decoding Time Stamp
- ESCR – Elementary Stream Clock Reference

Packetizing and Transport

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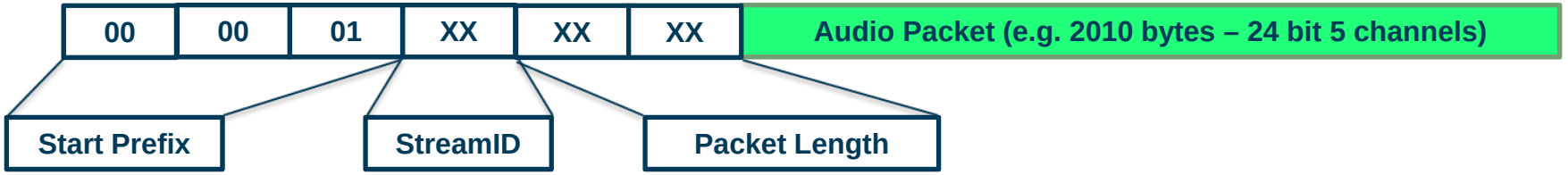
- Packetized Elementary Stream



- PES Header (6 bytes)

Name	Size
Start prefix	3 bytes
StreamID	1 byte
Packet Length	2 byte
Optional PES Header	variable
Stuffing Bytes	variable

- optional PES Header

Name	Size	Name	Size
Marker bits	2 bits	ES flag	1 bit
Scrambling control	2 bits	Trick mode flag	1 bit
Priority	1 bit	Add. copy info	1 bit
Data alignment	1 bit	CRS flag	1 bit
Copy right	1 bit	Extension flag	1 bit
Original or copy	1 bit	PES header length	8 bits
PTS/DTS indicator	2 bits	Optional fields	variable
ESCR flag	1 bit	Stuffing bytes	variable

- StreamID

0xC0 – 0xDF for audio content
0xE0 – 0xEF for video content

- PTS - Presentation Time Stamp
- DTS - Decoding Time Stamp
- ESCR – Elementary Stream Clock Reference

Packetizing and Transport

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- **Packetized Elementary Stream**
  - PTS/DTS Indicator
    - 00 no PTS/DTS
    - 01 forbidden
    - 10 PTS available
    - 11 PTS/DTS available
  - PTS/DTS Data
    - 5/10 bytes appended on the Header Data Field

PTS available

7 6 5 4	3 2 1	0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1	0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1	0
0010	PTS 32..30	1	PTS 29..15		1	PTS 14..00		1

PTS/DTS available

7 6 5 4	3 2 1	0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1	0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1	0
0011	PTS 32..30	1	PTS 29..15		1	PTS 14..00		1
0001	DTS 32..30	1	DTS 29..15		1	DTS 14..00		1

Packetizing and Transport

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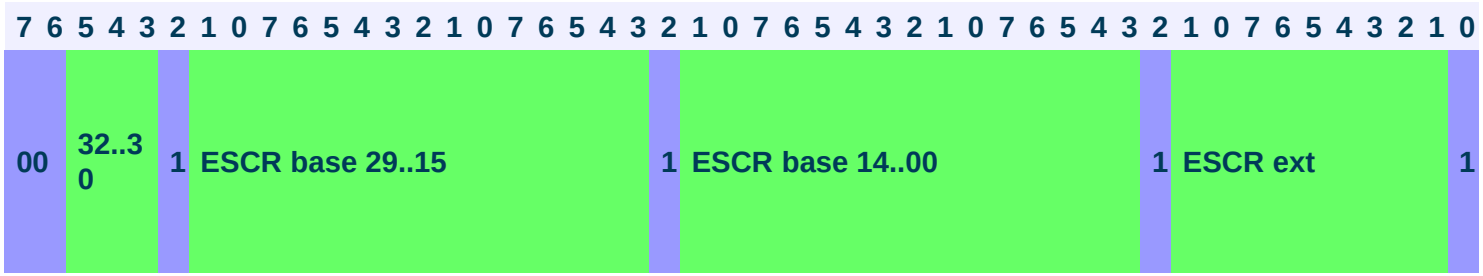
- **Packetized Elementary Stream**
  - ESCR Indicator
  - 6 Bytes are appended to the Header

ESCR available



Packetizing and Transport

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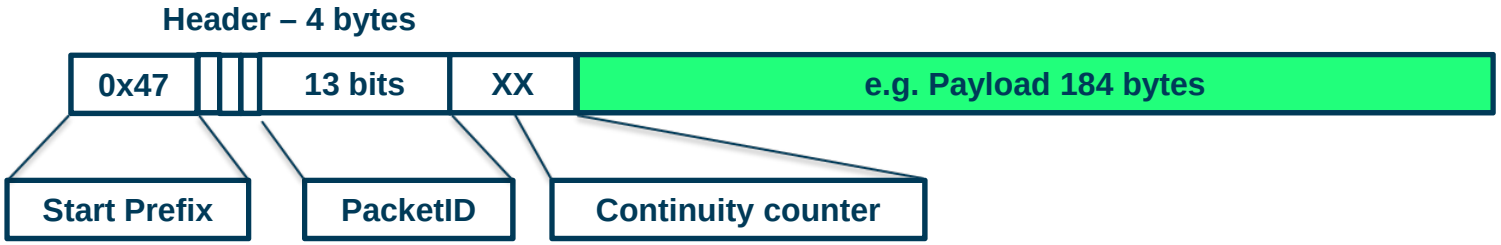
- **Transport Stream**



- **TS Header**

Name	Size	Name	Size
Start Prefix	8 bits	Scrambling Control	2 bits
Transport Error	1 bit	Adaption Field Ind.	2 bits
Payload Start	1 bit	Continuity Counter	4 bits
Transprot Priority	1 bit	Adaption Field	0 or more
PacketID	13 bits	Payload	0 or more

- **Adaption Field**

Name	Size	Name	Size
Adaption Length	8 bits	Private data Ind.	1 bit
Discontinuity	1 bit	Extension flag	1 bit
Random Access	1 bit	PCR	33+6+9
Priority Indicator	1 bit	OPCR	33+6+9
PCR flag	1 bit	Splice Countdown	8 bits
OPCR flag	1 bit	Stuffing bytes	Variable
Splicing flag	1 bit		

- PCR - Program Clock Reference
- OPCR - Original Program Clock Reference

Transport Stream Multiplexing

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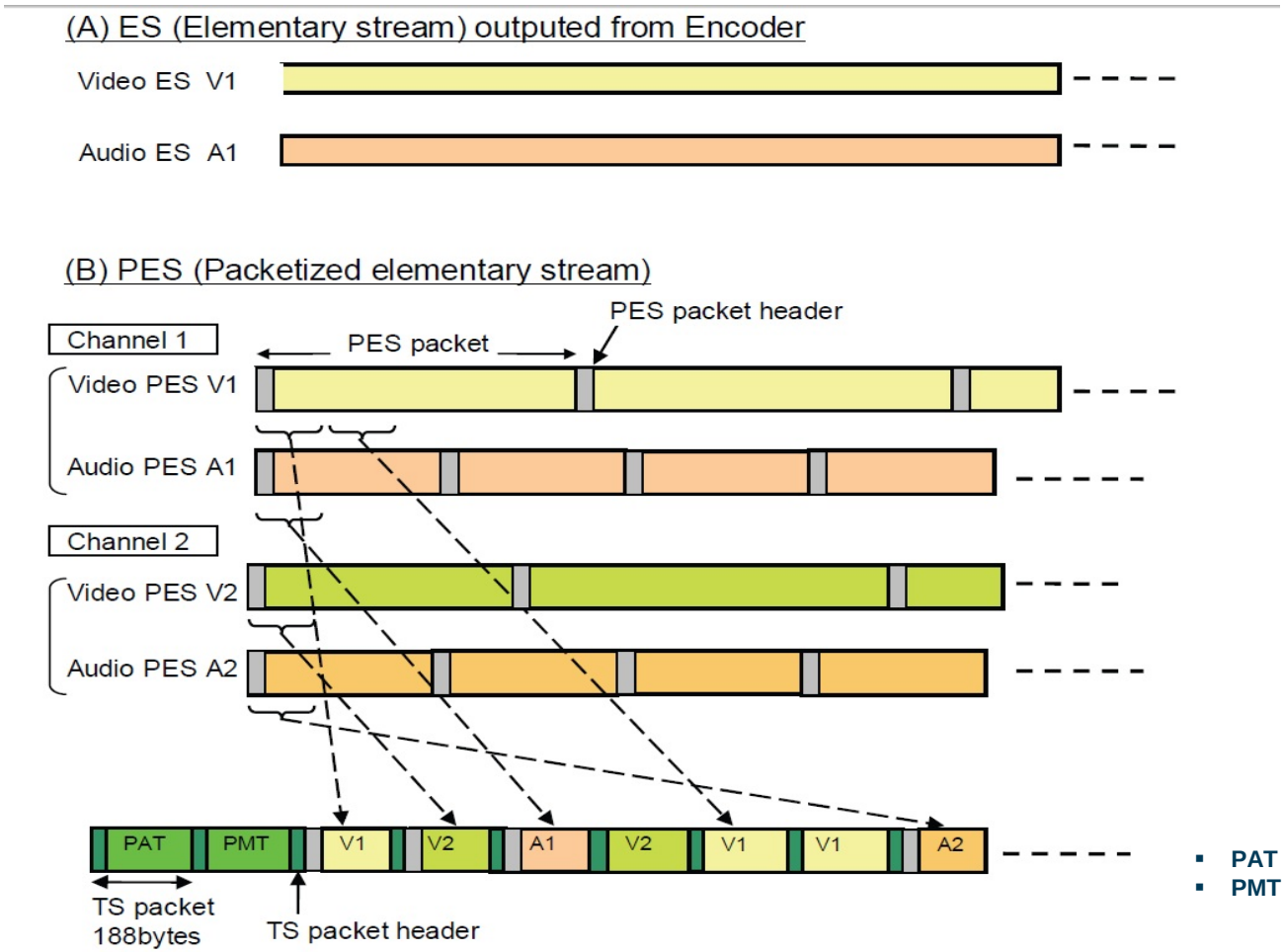
- **PES to TS muxing**



- **PAT – Program Association Table**
- **PMT – Program Map Table**

Encryption (HDCP-IIA based)

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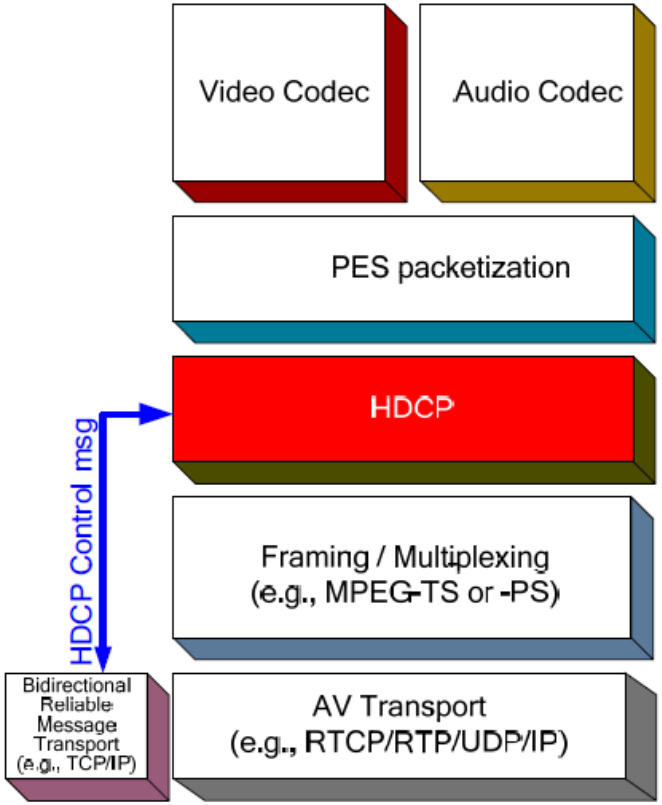
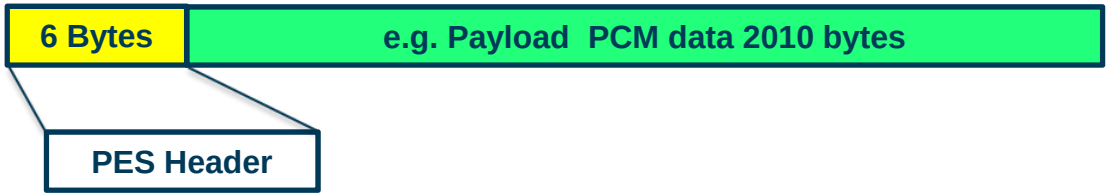
- **Encryption by using the HDCP Interface Independent Adaptation (HDCP 2.x)**
  - Packetized Elementary Stream has to be used
  - the method for multiplexing and AV transport is open

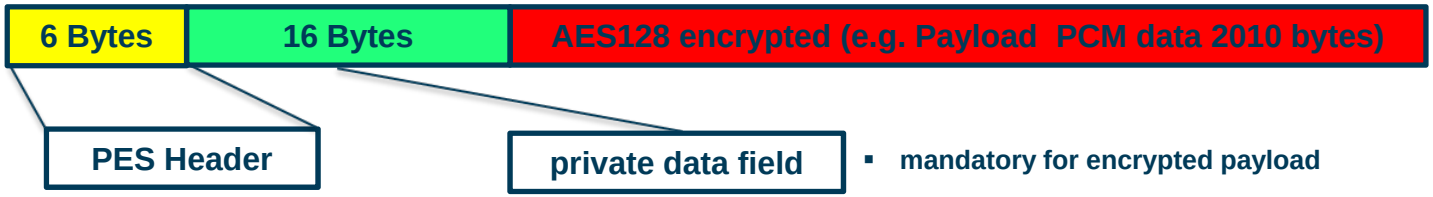


Encryption (HDCP-IIA based)

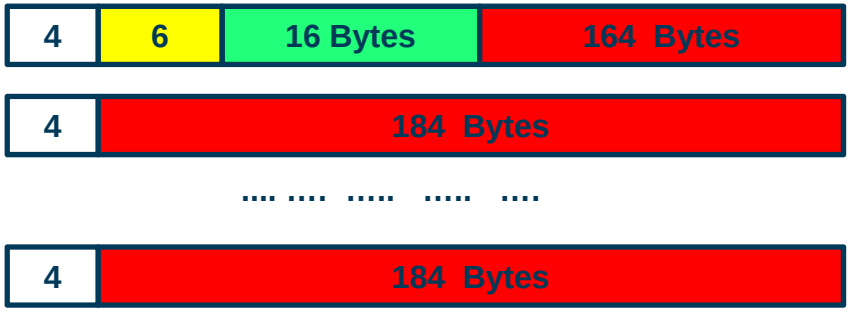
- A/V Data -> Packetized Elementary Stream -> HDCP Encryption -> Transport Stream



- Packetized Elementary Stream



- Encrypted PES
- mandatory for encrypted payload



- Transport Stream Packet 0
- Transport Stream Packet 1

....

- Transport Stream Packet n

Encryption (HDCP-IIA based)

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- **Private data field**
  - mandatory
  - added to every encrypted PES
  - signals that encrypted PES is present
  - 4 byte stream counter
  - 8 bytes input counter
  - used instead of the PES scrambling control bits

WHERE SOUND MATTERS

AKG harman/kardon Infinity JBL Lexicon mark Levinson