



- 지상파 DMB 표준화 II -  
MPEG-4 멀티미디어 서비스

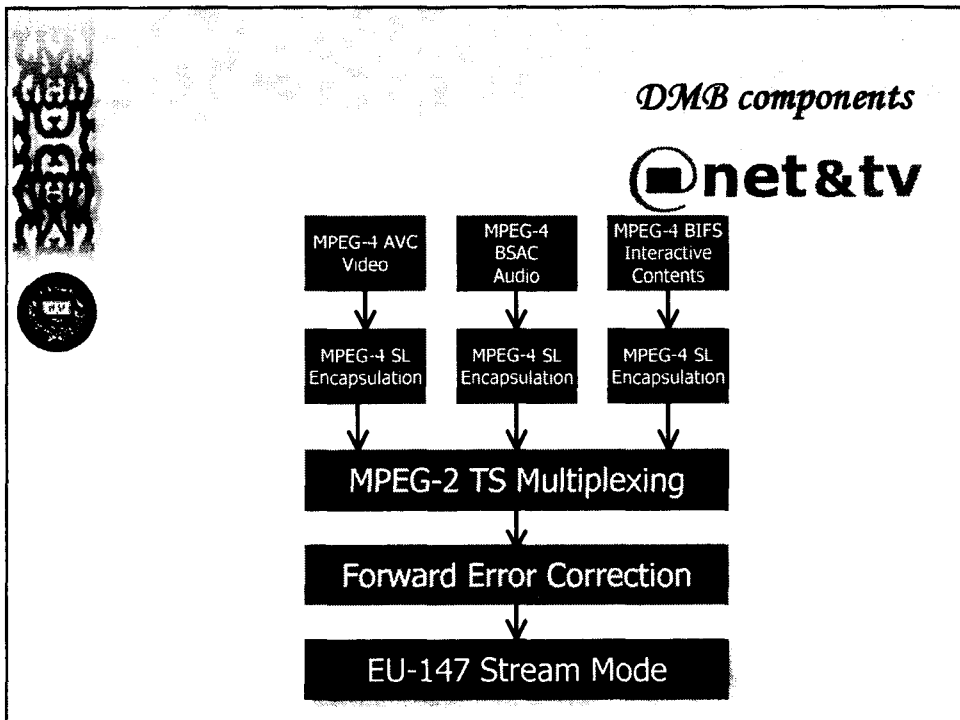
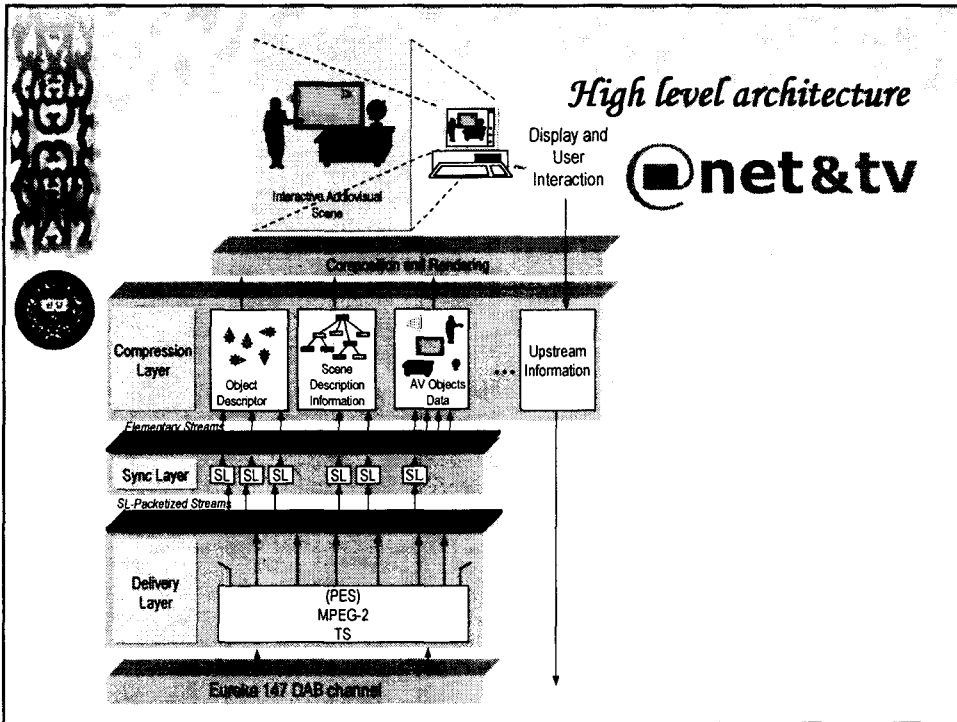
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young@netntv.co.kr



- High-level architecture
- FEC
- Transport
- Adaptation
- Video
- Audio
- Graphics & Data
- Conclusion

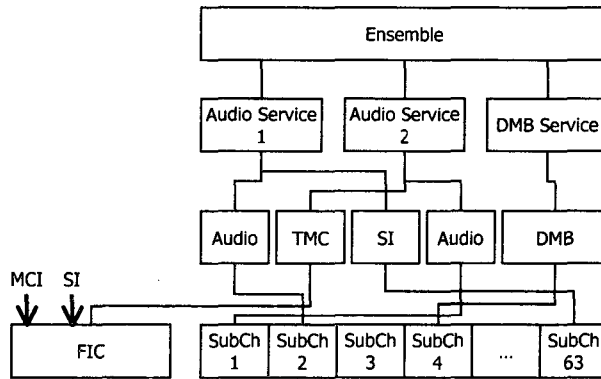
*Contents*







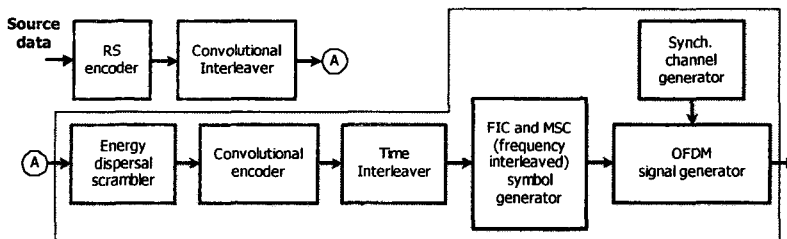
## DMB Service Structure



## FEC



- Target BER =  $10^{-8}$
- Two well-known methods
  - convolutional interleaving
  - reed-solomon coding



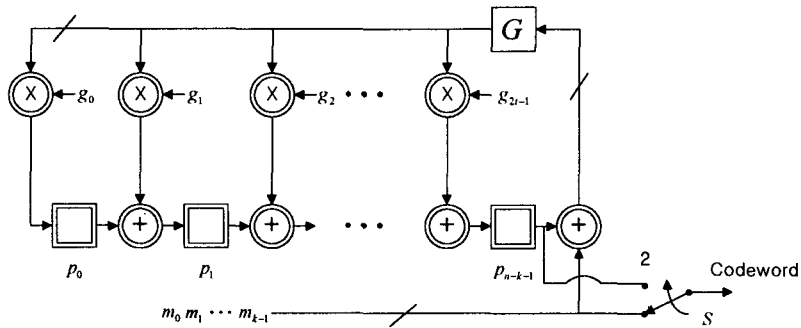


RS

net&tv

RS(255,239,t=8) → RS(188, 204, t=8)

- 코드 발생 다항식 :  $g(x) = (x+\lambda_0)(x+\lambda_1)(x+\lambda_2)(x+\lambda_3)\dots(x+\lambda_{15})$ ,  $\lambda = 02(\text{HEX})$
- 필드 발생 다항식:  $p(x) = x^8 + x^4 + x^3 + x^2 + 1$

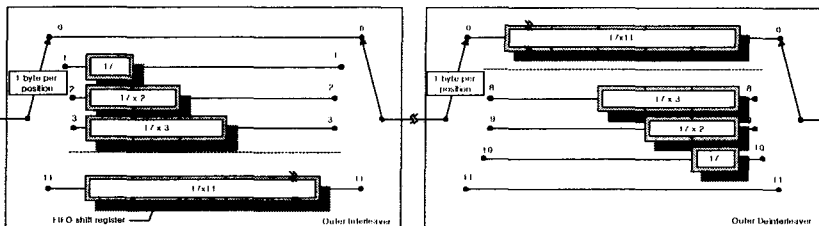


Convolutional Interleaver

net&tv

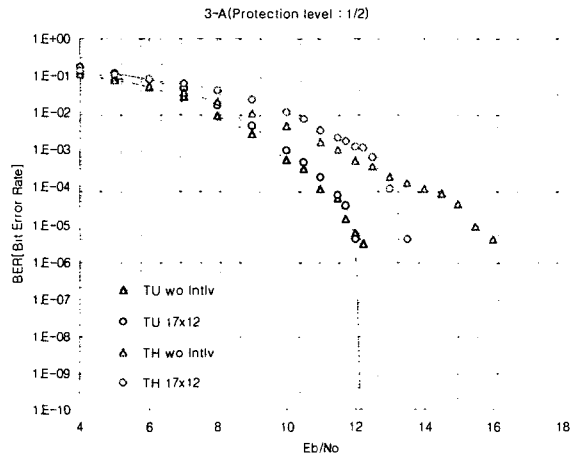
ETS 300 744

- 17x12
- no interleaving for sync. byte





Performance



MPEG-2 TS



- Stream Multiplexing
  - Program association table
  - Program map table
  - PID, stream\_id
- Random Access
  - Fixed size TS packets with sync. byte
  - Start codes
- Framing
  - variable size PES (Packetized elementary stream) packet
  - fixed sized TS packet



# TS packet headers



Sync Byte (8)	Transport Error Indicator (1)	Payload UnitStart Indicator (1)	Transport Priority (1)	PID (13)	Transport Scrambling Control (2)	Adaptation Field Control (2)	Continuity Counter (4)	Adaptation Field
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Adaptation Field Length(8)	Discontinuity Indicator (1)	Random Access Indicator (1)	Elementary Stream Priority Indicator (1)	SFlag (1)	Optional Field	Stuffing Bytes
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PCR (42)	OPCR (42)	Splice Countdown (8)	Transport Private Data Length (8)	Transport Private Data	Adaptation Field Extension Length (8)	3 Flags	Optional Fields
Ltw_valid Flag (1)	LtwOffset (15)	Pecewise Rate (22)	Splice Type (4)	DTS_next_Lau (33)			



# PES packet headers



Packet Start Code Prefix (24)	Stream ID (8)	PES Packet Length (16)	Optional PES HEADER	PES Packet Data Bytes
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10 Scrambling Control (2)	PES Priority (1)	Data Alignment Indicator (1)	Copy right (1)	Original Or Copy (1)	7 Flags (8)	PES Header Data Length (8)	Optional Field	Stuffing Bytes (0xFF)
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PTS(33)	ESCR (42)	ES Rate (22)	DSM Trck Mode (8)	Additional Copy Info (7)	Previous PES CRC (16)	PES Extension (16)
DTS(33)						
		SFlags		Optional Fields		
PES Private Data (128)	Pack Field length (8)	Program Packet Sequence Counter (16)	P-STD Buffer (16)	PES Extension Field Length (8)	PES Extension Field Data	



MPEG-4 SL



- Synchronization

- CTS (Composition Time Stamps)
- DTS (Decoding Time Stamps)

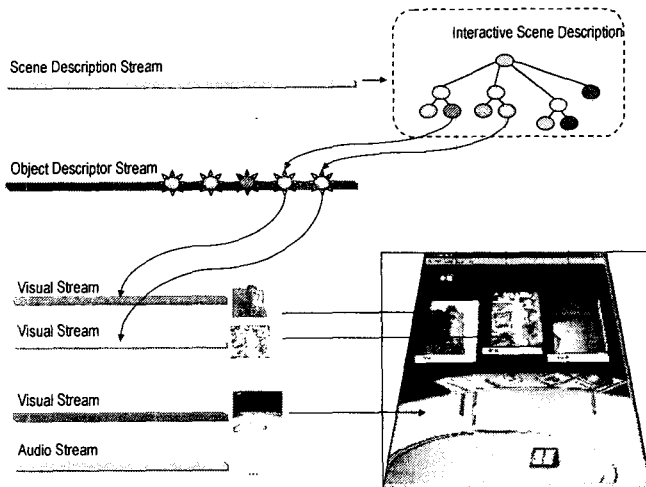


- Interactive composite multimedia

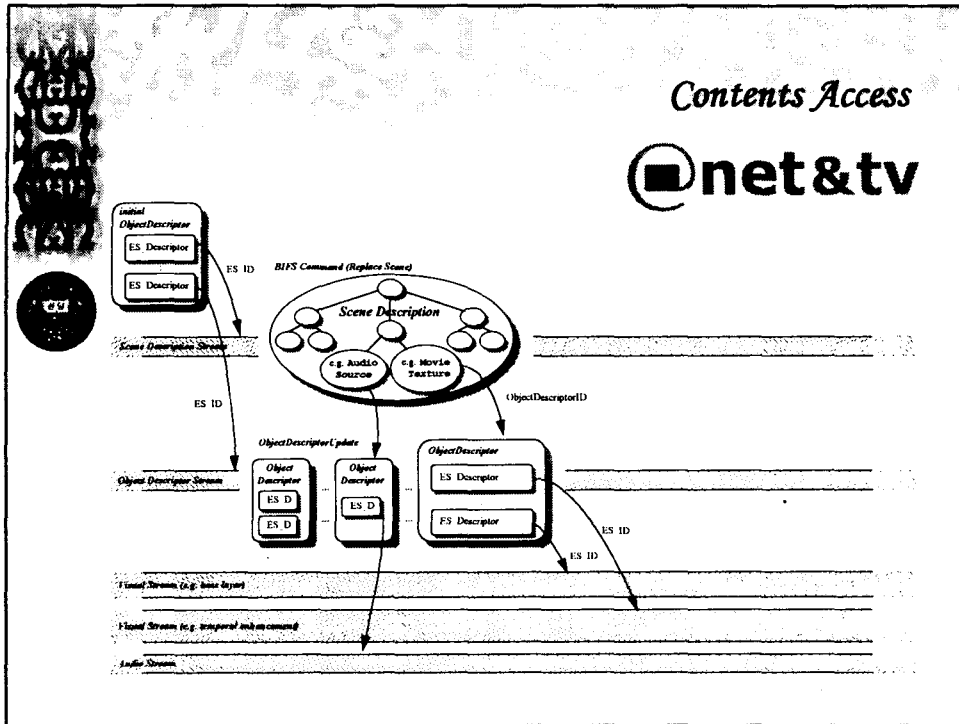
- OD Framework
- Scene Description



MPEG-4 Contents



## Contents Access



## SL packet encapsulation



- useAccessUnitStartFlag
- useAccessUnitEndFlag
- useTimeStampsFlag
- durationFlag
  - timeScale
  - accessUnitDuration
  - compositionUnitDuration
- timeStampResolution : 90kHz
- OCRResolution : 90kHz
- timeStampLength : ≤ 32 bits
- OCRLength : ≤ 33bits
- AU\_Length
- instantBitrateLength





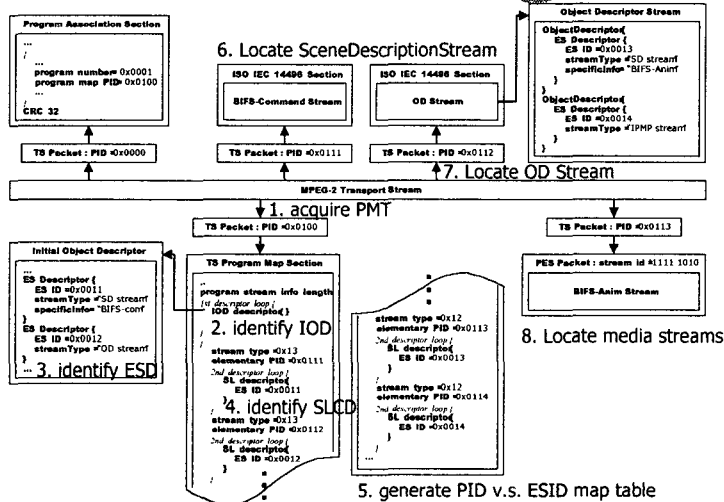
4on2



- A scene may also refer streams carried by other means.
- Timing relationship
  - MPEG-4 OTB (Object Time Base) is locked to the MPEG-2 STC (System Time Clock)
  - Number of restrictions are applied to MPEG-4 OTB
- SL-packetized streams in PES packets
  - Stream\_id = 0xFA
  - A single SL-packetized stream may be mapped into a single PES
  - One and only one SL packet shall consist the payload of PES packet
- ObjectDescriptorStream or SceneDescriptionStream in sections



### 4on2 Content Access Procedure





## Core2D Scene Description Profile



- basic 2D composition
- 2D texturing
- local interaction
- local animation
- BIFS updates
- quantization
- access to web links and sub-scenes
- back channel (*ServerCommand*)
- VoD features (*MediaControl, MediaSensor*)



## Core2D Graphics Profile



- Appearance
- Background2D
- Bitmap
- Circle
- Color
- Coordinate2D
- FontStyle
- IndexedFaceSet2D
- Material2D
- PixelTexture
- Rectangle
- Shape
- Text



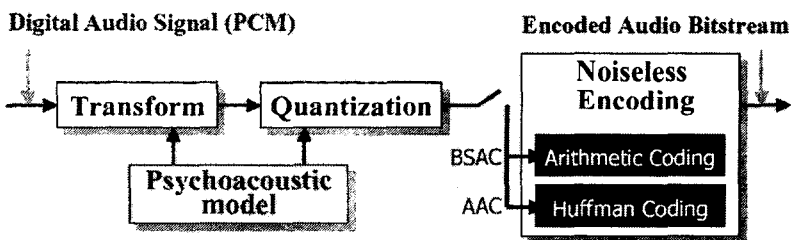
## Targeted applications



- Video on Demand
  - interactive audio-video over the Internet
  - scalable content delivery
- Enhanced digital TV
  - MPEG-4 video over MPEG-2 Picture in Picture
  - Interactive Electronic Program Guides
  - enriched TV programs
- Advertisement
  - animated banners
  - video warping and incrustation
  - Personalization
  - web links
- Interactive presentations
  - basic graphics animations
  - e-commerce
  - interactive contests or voting

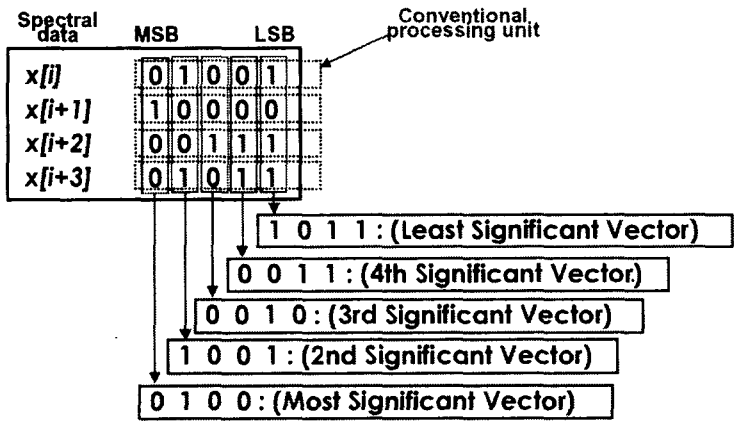


## Improving AAC

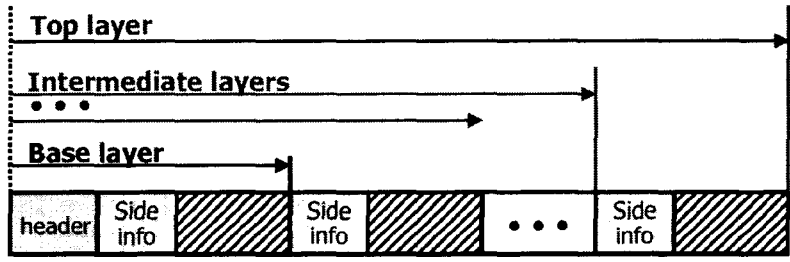




# Bit Sliced Coding



# Bitstream structure





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## *MPEG-4 AVC*



- Advanced Video Coding (ISO/IEC 14496-10)
- ITU-T H.264
- JVT from December 2001
  - ITU-T VCEG (Video Coding Expert Group)
  - ISO/IEC JTC1 SC29 WG 11 MPEG Video Group
- H.26L as a starting point
- FDIS at March 2003
- High encoding complexity
- Three profiles
  - Baseline
  - Main
  - Extended



## Overview



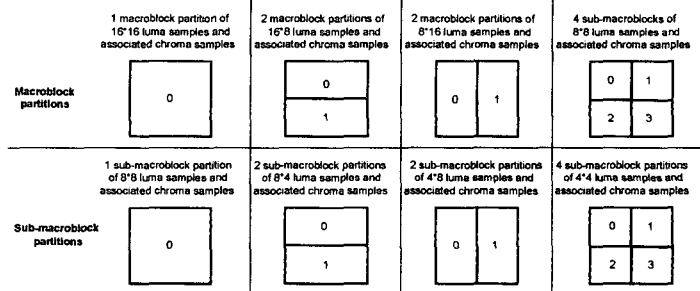
- Same architecture but different algorithms
  - Various Image format & structure
    - QCIF, CIF, ... - 16x16 Macroblock base
    - Intra picture / Inter picture / Bi-directional inter picture
  - Motion Estimation/Compensation
  - Residual(H.264) or Texture(MPEG-4) Coding
    - Transform & Inverse Transform
    - Quantization & Inverse Quantization
  - Entropy Coding



## Motion Compensation



- Various block sizes and shapes for motion compensation
- 1/4 sample accuracy motion
- Multiple reference pictures (per H.263++ Annex U)
- Temporally-reversed motion and generalized B-frames
- B-frame prediction weighting





## *Residual and Intra Coding*



- Transform
  - Based primarily on 4x4 transform (all prior standards: 8x8)

$$H = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 2 & 1 & -1 & -2 \\ 1 & -1 & -1 & 1 \\ 1 & -2 & 2 & -1 \end{bmatrix}$$

- Expanded to 8x8 for chroma by 2x2 transform of the DC values
- Adaptive block transform sizes for Main Profile
- Intra Coding Structure
  - Directional spatial prediction (6 types luma, 1 chroma)
  - Expanded to 16x16 for luma intra by 4x4 transform of the DC values



## *Entropy Coding*



- Exp-Golomb code is used universally for all symbols except for transform coefficients
- Context adaptive VLCs for coding of transform coefficients
  - No runs: number of coefficients is transmitted
  - Coefficients are scanned backwards
  - Contexts are build dependent on tranfro





*BSAC*



- Bit Sliced Arithmetic Coding
- ISO/IEC IS 14496-3:2001
- Fine Granular Scalability
  - 16kbps/ch(base layer) ~ 64kbps/ch(top layer)
  - step size : 1kbps/ch
- Change of noiseless coding tool from AAC-LC
- Comparable coding performance with AAC



*Conclusion*



- EU-147 Stream Mode
- FEC : RS + Convolutional Interleaving
- Transport : MPEG-2 TS
- Adaptation : MPEG-4 SL
- Video : MPEG-4 AVC Baseline Profile
- Audio : MPEG-4 BSAC
- Graphics & Data : MPEG-4 System Core2D Profile



*Acknowledgement  
to  
All of M<sup>2</sup>B members*

