MPEG-2 Video Coding Standard For Digital TV Broadcasting

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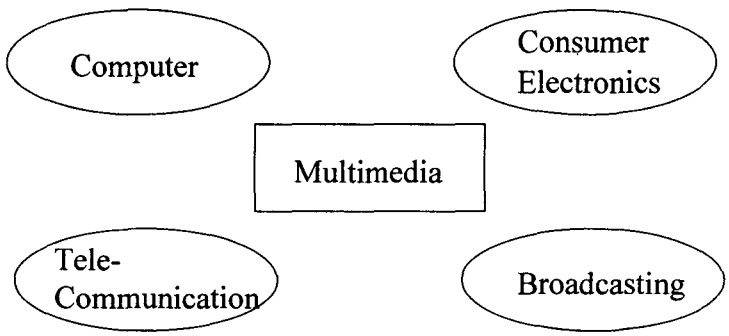
Multimedia Everywhere

- **Towards Multimedia :**



Moving Picture Compression Standards

- 1982 : ITU-R BT.601 : Studio Quality PCM Component Video
  Common to 525/60 and 625/50 Systems
  13.5 MHz Sampling, 8 bit/sample, 4:2:2 Format

- 1990 : ITU-T H.261 : Video Phone/Conference Application via ISDN
  Bitrate = p x 64 kbps, p = 1-30
  MC DPCM + DCT + Q + RLE + Huffman Codes
  Reference Model 1 - 8

- 1992 : MPEG-1 Video : DSM Applications (e.g. Video CD)
  Bitrate = 1.5 Mbps
  MC DPCM + DCT + Q + RLE + Huffman Codes
  GOP Structure for Random Access and Error Recovery
  (I, P, B Frames)
  Simulation Model 1 - 3

Moving Picture Compression Standards (Continued)

- 1994 : MPEG-2 Video (ISO 13818-2, ITU-T H.262) :
  Generic Algorithm for Various Applications
  (Broadcasting, Communication, Network, DSM etc)
  5 Profiles of Functionality
  (Simple, Main, Spatial Scalable, SNR Scalable, High)
  4 Levels of Resolution (Low, Main, High-1440, High)
  Deals with Interlaced Scan as well as Progressive Scan
  Field/Frame ME & DCT, Dual Prime ME, Intra VLC,
  Altenate Scan, Nonuniform Q, etc

- 1993 : ITU-R CMTT.721 : 140 Mbps Contribution Quality Video
  Adaptive DPCM, Componentwise

- 1993 : ITU-R CMTT.723 : 34-45 Mbps Contribution Quality Video
  MC DPCM + DCT + Q + RLE + Huffman Codes

Moving Picture Compression Standards (Continued)

- 1995 : ITU-T H.263 : Videophone via PSTN
  Bitrate < 64 kbps
  (V.34 modem = 33.6 kbps, Recent modem = 56 kbps)
  Improved version of H.261

- 1998 : MPEG-4
  Bitrates < 2 Mbps
  Targets: Multimedia data base access
  Wireless multimedia communication
  Components of H.263 are incorporated
  Content-based compression
  Synthetic and natural video/audio
  Multiple tools/algorithms/profiles => Flexibility

- 1999 : MPEG-4 Version 2, MPEG-7

Audio Compression Standards

- 1982 : CD-DA (Red Book) : 74 Minutes Hi-Fi PCM Audio
  44.1 kHz sampling x 16 bit/sample x 2 (stereo) = 1.5 Mbps
- 1984 : ITU-T J.41 : 384 kbps FM Quality, 15 kHz sampling
- 1985 : Digital Audio Tape : 120 Munutes Hi-Fi PCM Audio
  48/44.1/32 kHz sampling, 16 bit/sample
- 1986 : ITU-T G.722 : 64/56/48 kbps AM Quality SB-ADPCM
  Teleconference Applications (50 Hz - 7 kHz)
  24-tap QMF + ADPCM for Low/High Bands
- 1992 : MPEG-1 Audio (ISO 11172-3) : Hi-Fi Stereo Audio
  up to 384 kbps for Layer II Stereo
  32 Subband + Adaptive Q + Adaptive Bit
  Allocation using HAS + Huffman Coding

Audio Compression Standards (Continued)

- 1994 : MPEG-2 Audio (ISO 13818-3) : Multi-channel/Multi-lingual
  up to 1.066 Mbps for 5.1 channels, 7 languages
  Backward Compatible with MPEG-1 Audio
- 1993 : DCC (Digital Compact Cassettee) : 1/4 Stereo Compression
- 1993 : MD (Mini Disc) : 1/5 Stereo Compression
- 1994 : Dolby AC3 : 320 kbps for 5.1 channels
  adopted by US HDTV and Film Industry
  TDAC + Floating Point Coefficients
  Non Backward Compatible with MPEG-1
- 1997 : MPEG-2 AAC : NBC mode
  Better Quality than MPEG-2 Audio
  AC-3 is partly incorporated.

MPEG Digital Video Technology

☐ **MPEG-1(ISO/IEC 11172) and MPEG-2(ISO/IEC 13818)**

Applications :

MPEG-1 : Digital Storage Media(CD-ROM...)

MPEG-2 : Higher bit rates and broader generic applications

(Consumer electronics, Telecommunications,
Digital Broadcasting, HDTV, DVD, VOD, etc.)

Coding scheme :

Spatial redundancy : DCT + Quantization

Temporal redundancy : Motion estimation and compensation

Statistical redundancy : VLC

References :

- ISO/IEC 11172-2 (MPEG-1), ISO/IEC 13818-2 (MPEG-2)
- K.R.RAO and J.J. HWANG, "TECHNIQUES & STANDARDS FOR IMAGE•VIDEO & AUDIO CODING," Prentice Hall, 1996.

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MPEG Overview

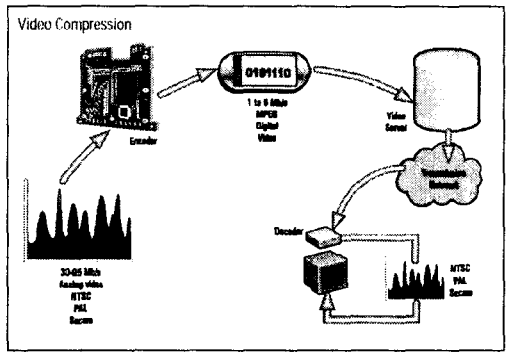
☐ **MPEG :**

- Motion Picture Experts Group
- Specifies a standard compression, transmission, and decompression scheme for video and audio.
- ISO/IEC 11172 : MPEG-1
- ISO/IEC 13818 : MPEG-2
- Consists of 3 parts.

  Part 1 : System

  Part 2 : Video

  Part 3 : Audio



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Functional comparison between MPEG-1 and MPEG-2 video

	MPEG-1	MPEG-2
Video format	SIF progressive	SIF, 4:2:0, 4:2:2, 4:4:4 progressive/interlaced
Picture quality	VHS	Distribution/contribution
Bit rate	Variable (≤ 1.856 Mbps)	Variable up to 100Mbps
Low delay mode	< 150 ms	< 150 ms (no B pictures)
Accessibility	Random access	Random access/channel hopping
Scalability		SNR, spatial, temporal, simulcast, data partitioning
Compatibility		Forward, backward, upward, and downward
Transmission error	Error protection	Error resilience
Editing bit stream	Yes	Yes
DCT	Noninterlaced	Field (progressive) or frame (interlaced)
Motion estimation	Noninterlaced	Field, frame, and dual-prime based. Top (16x8) block and bottom (16x8) block
Motion vectors	Motion vectors for P, B picture only	Concealment motion vectors for I pictures besides MV for P & B
Scanning of DCT coefficients	Zigzag scan	Zigzag scan, alternate scan for interlaced video

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MPEG System Structure

☐ MPEG System Stream Structure

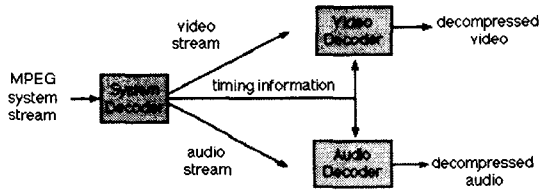
MPEG system stream is made up of two layers

- System layer : timing and other information

  demultiplex and synchronize the audio and video streams

- Compression layer : audio and video streams

☐ General Decoding Process



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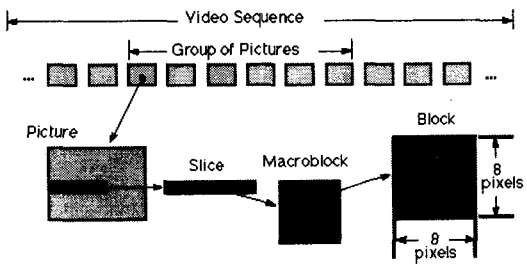
Video Stream Data Hierarchy

☐ Video Stream Data Hierarchy



Video Sequence

- Begins with a sequence header (may contain additional sequence headers).
- Includes one or more groups of pictures, and ends with an end-of-sequence code.

Group of Pictures (GOP)

- A header and a series of one or more pictures intended to allow random access into the sequence.

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Video Stream Data Hierarchy (Cont.)

Picture

- The primary coding unit of a video sequence.
- Consists of three rectangular matrices representing luminance (Y) and two chrominance (Cb and Cr) values.

Slice

- One or more ``contiguous" macroblocks.
- Slices are important in the handling of errors.
  If the bitstream contains an error, the decoder can skip to the start of the next slice.

Macroblock

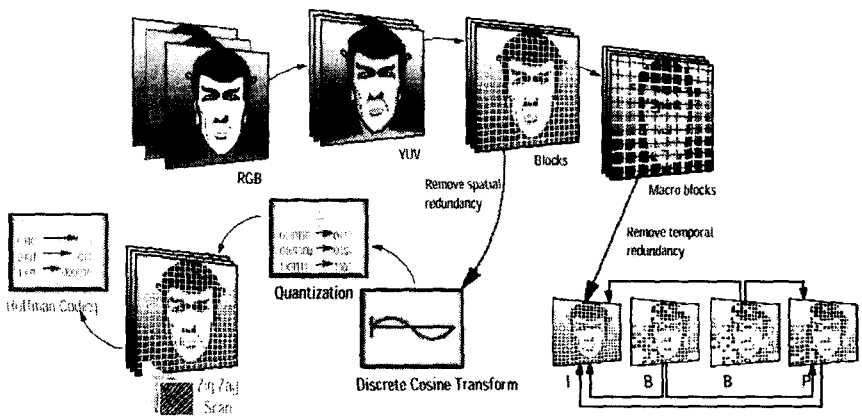
- A 2 by 2 section of Block (4 Y blocks + 1 Cb block + 1 Cr block)
- Basic unit for motion estimation and motion compensation

Block

- A block is an 8-pixel by 8-line set of values of a luminance or a chrominance component.
- Basic unit for DCT (discrete cosine transform)

MPEG compression of Video

☐ **How to remove spectral, spatial, temporal, and statistical redundancy?**



FDCT and IDCT

❒ Two-dimensional FDCT and IDCT

Zero shift for input signal

- $[0, 2^P - 1] \Rightarrow [-2^{P-1}, 2^{P-1} - 1]$ (p=8 or 12)
  reduce the internal precision requirement in the DCT calculation

858 DCT

- efficient energy compaction(close to KLT)
- blocking artifacts at high compression ratios

Definition

$$F(u,v) = \frac{1}{4} C(u)C(v)\left[\sum_{x=0}^{7}\sum_{y=0}^{7} f(x,y)\cos\frac{(2x+1)u\pi}{16}\cos\frac{(y+1)v\pi}{16}\right]$$

$$f(x,y) = \frac{1}{4}\left[\sum_{u=0}^{7}\sum_{v=0}^{7} C(u)C(v)F(u,v)\cos\frac{(2x+1)u\pi}{16}\cos\frac{(y+1)v\pi}{16}\right]$$

$$C(u), C(v) = 1/\sqrt{2} \quad \text{for } u, v = 0$$

$$C(u), C(v) = 1 \quad \textit{otherwise}$$

- Fast FDCT and IDCT algorithms exist, e.g. Lee algorithm.

Quantization and inverse quantization

❒ Quantization table

- No default values for quantization tables
- Application may specify the tables
- Q(u, v) : quantization table
  integer value from 1 to 255

$$\textit{Quantization} \quad : F^Q(u,v) = round\left(\frac{F(u,v)}{Q(u,v)}\right)$$

$$\textit{Dequantization}: \quad R(u,v) = F^Q(u,v) \times Q(u,v)$$

Table 8.1 Luminance quantization matrix Q_{uv} (example only) [367]

16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

Source: © 1993 ITU-T.

Table 8.2 Chrominance quantization matrix Q_{uv} (example only) [367]

17	18	24	47	99	99	99	99
18	21	26	66	99	99	99	99
24	26	56	99	99	99	99	99
47	66	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99

Source: © 1993 ITU-T.

Example

$f(x,y)$

$$\begin{pmatrix} 79 & 75 & 79 & 82 & 82 & 86 & 94 & 94 \\ 76 & 78 & 76 & 82 & 83 & 86 & 85 & 94 \\ 72 & 75 & 67 & 78 & 80 & 78 & 74 & 82 \\ 74 & 76 & 75 & 75 & 86 & 80 & 81 & 79 \\ 73 & 70 & 75 & 67 & 78 & 78 & 79 & 85 \\ 69 & 63 & 68 & 69 & 75 & 78 & 82 & 80 \\ 76 & 76 & 71 & 71 & 67 & 79 & 80 & 83 \\ 72 & 77 & 78 & 69 & 75 & 75 & 78 & 78 \end{pmatrix}$$

FDCT →

$F(u,v)$

$$\begin{pmatrix} 619 & -29 & 8 & 2 & 1 & -3 & 0 & 1 \\ 22 & -6 & -4 & 0 & 7 & 0 & -2 & -3 \\ 11 & 0 & 5 & -4 & -3 & 4 & 0 & -3 \\ 2 & -10 & 5 & 0 & 0 & 7 & 3 & 2 \\ 6 & 2 & -1 & -1 & -3 & 0 & 0 & 8 \\ 1 & 2 & 1 & 2 & 0 & 2 & -2 & -2 \\ -8 & -2 & -4 & 1 & 2 & 1 & -1 & 1 \\ -3 & 1 & 5 & -2 & 1 & -1 & 1 & -3 \end{pmatrix}$$

Quant. →

$F^Q(u,v)$

$$\begin{pmatrix} 39 & -3 & 1 & 0 & 0 & 0 & 0 & 0 \\ 2 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Inverse Q & IDCT →

$r(x,y)$

$$\begin{pmatrix} 74 & 75 & 77 & 80 & 85 & 91 & 95 & 98 \\ 77 & 77 & 78 & 79 & 82 & 86 & 89 & 91 \\ 78 & 77 & 77 & 77 & 78 & 81 & 83 & 84 \\ 74 & 74 & 74 & 74 & 76 & 78 & 81 & 82 \\ 69 & 69 & 70 & 72 & 75 & 78 & 82 & 84 \\ 68 & 68 & 69 & 71 & 75 & 79 & 82 & 85 \\ 73 & 73 & 72 & 73 & 75 & 77 & 80 & 81 \\ 78 & 77 & 76 & 75 & 74 & 75 & 76 & 77 \end{pmatrix}$$

$e(x,y)$

$$\begin{pmatrix} 5 & 0 & 2 & 2 & -3 & -5 & -1 & -4 \\ -1 & 1 & -2 & 3 & 1 & 0 & -4 & 1 \\ -6 & -2 & -10 & 1 & 2 & -3 & -9 & -2 \\ 0 & 2 & 1 & 1 & 10 & 2 & 0 & -3 \\ 4 & 1 & 5 & -5 & 3 & 0 & -3 & 1 \\ 1 & -5 & -1 & -2 & 0 & -1 & 0 & -5 \\ 3 & 3 & -1 & -2 & -8 & 2 & 0 & 2 \\ -6 & 0 & 2 & -6 & 1 & 0 & 2 & 1 \end{pmatrix}$$

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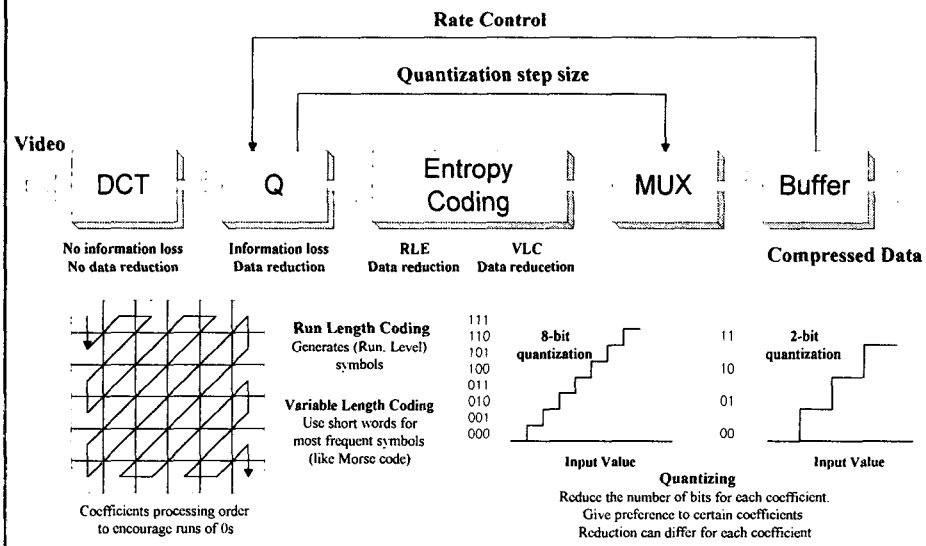
Intra-frame Compression



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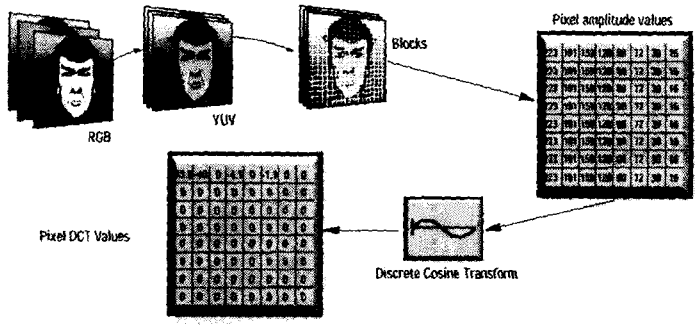
Spatial redundancy

☐ **Pixel Coding using the DCT**

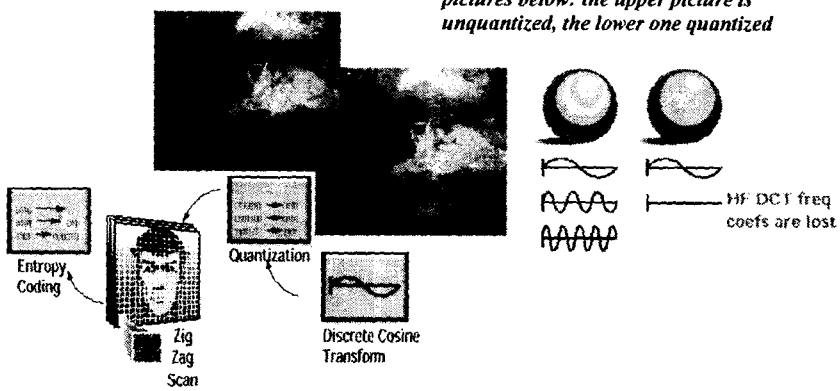


- As human eyes are insensitive to HF color changes, the R,G, B signal is converted into a luminance and two color difference signals. We can remove redundancy more on U, V than on Y.
- The top left DCT component is taken as the dc datum for the block.
- DCT coefficients to the right are increasingly higher horizontal spatial freqs. DCT coefficients below are higher vertical spatial frequencies.

Spatial redundancy (Cont.)

☐ **Quantization & Entropy coding**

This all has a cost. That is shown in the pictures below: the upper picture is unquantized, the lower one quantized

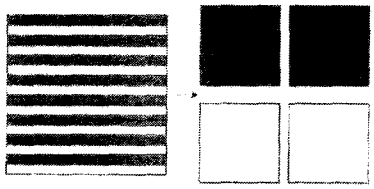


- The higher the DCT frequency is, the greater the Quant Matrix value becomes. This makes many coefficients go to zero
- To generate efficient (Run, Level) symbols, Zig-zag scanning is applied to the quantized 8×8 DCT coefficients

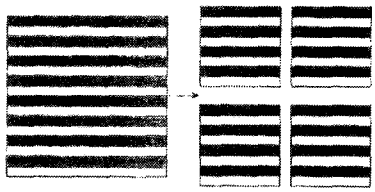
Field & Frame based mode in MPEG-2

• For interlaced video format, MPEG-2 provides two coding modes :

Field-based mode, Frame-based mode

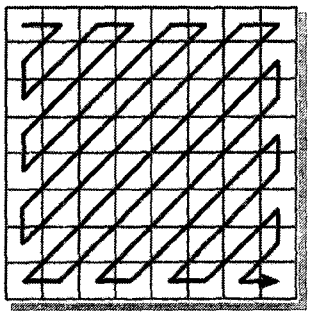


Mapping from 16×16 Blocks to 8×8 Blocks for Frame-Organized Data

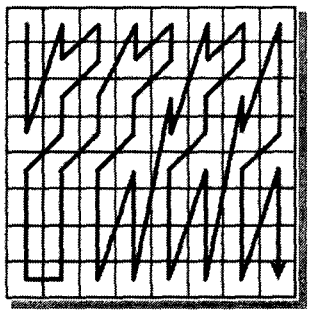


Mapping from 16×16 Blocks to 8×8 Blocks for Field-Organized Data

Two scanning methods of the DCT coefficients in MPEG-2



(a) Zigzag scan



(b) Alternate scan

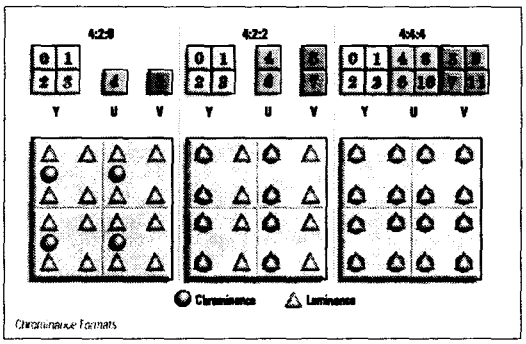
• Zigzag scan is typical for progressive (noninterlaced) mode processing.

• Alternate scan is more efficient for interlaced format video.

Chrominance Format

☐ **There are three formats :**

- ***4:4:4***... the chrominance and luminance planes are sampled at the same resolution.
- ***4:2:2***... the chrominance planes are subsampled at half resolution in horizontal direction.
- ***4:2:0***... the chrominance planes are subsampled at half resolution in both horizontal and vertical directions.



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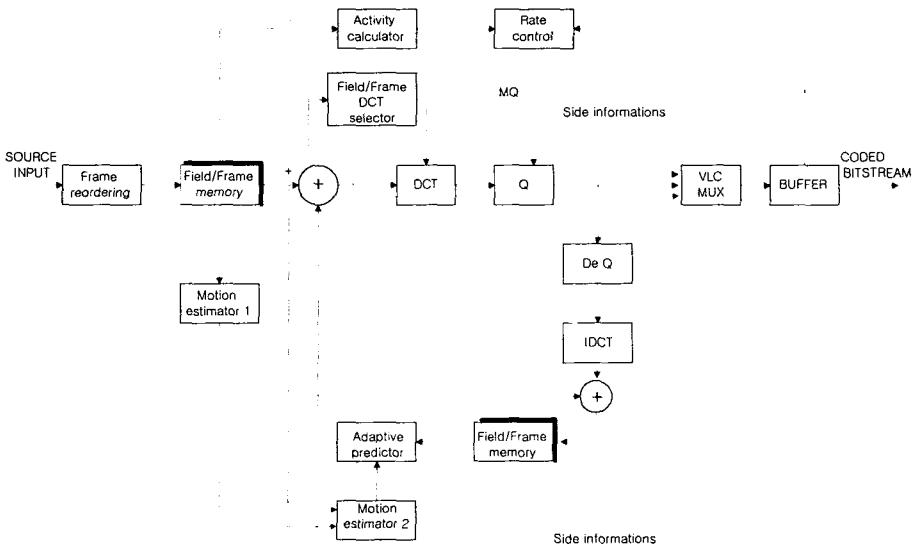
Inter-frame Compression



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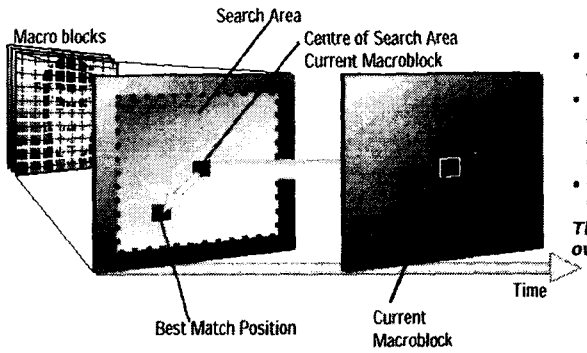
Temporal redundancy

☐ **Inter-frame prediction & motion estimation**



- If adjacent frame macroblocks same, don't retransmit block.
- Search to see if same block exists somewhere else: if it does, just transmit its coordinates (motion vectors).
- Only Intra-code macroblocks which are completely new.

This process really drops the overall bit rate

- ***This really reduces the overall bit rate from frame to frame***

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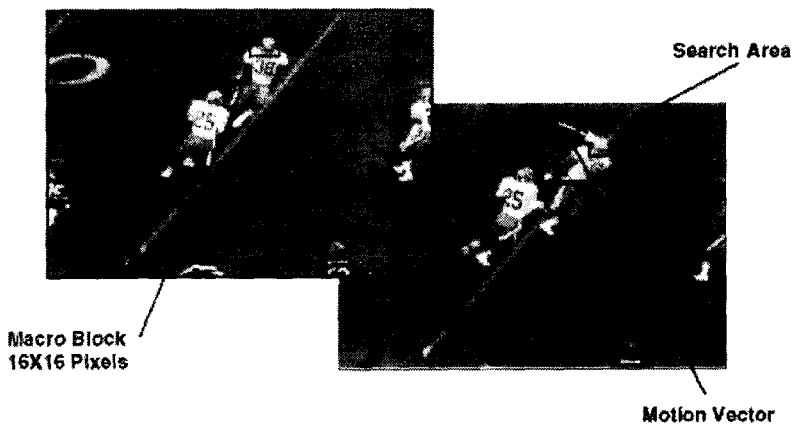
Motion Estimation



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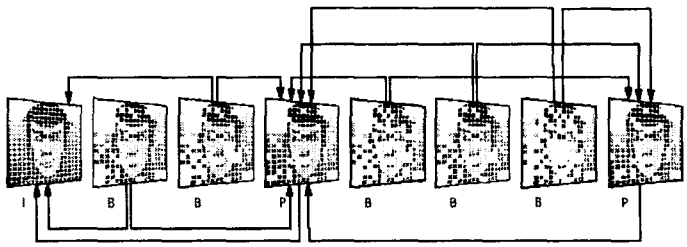
Putting it all together

☐ I, P, B Frames



- I-frames: contain full picture information
- P-frames: predicted from past I or P frames
- B-frames: use past and future I or P frames

- The Intra Frames contain full picture information
- Predicted(P) Frames are predicted from past I, or P frames
- Bi-directional predicted frames offer the greatest compression and use past and future I & P frames for motion compensation.

MPEG-2 Level and Profiles

Level	Application
Simple	Same as main but without B-frames, primarily intended for software decoders
Main	Low-cost single chip implementation for cable TV and satellite uplink compression
Spatial	Main with spatial scalability, e.g. HDTV
SNR	Spatial with SNR scalability
High	SNR with 4:4:4 chrominance in the macroblocks

This expandability of MPEG-2 format allows it to serve the needs of many different kinds of application.

This is aided by defining several levels of decoders, and several profiles of video source.

Profile	Target Bit-Rate	Quality	Application
Low	4 Mb/s	352 x 240 x 30	VHS equivalent
Main	15 Mb/s	720 x 480 x 30	Broadcast quality
High-1440	60 Mb/s	1440 x 1152 x 30	HDTV
High	80 Mb/s	1920 x 1080 x 30	Film production

Upperbound parameters in profile and levels

Profile	Level	H.size (pels)	V.size (pels)	Frame rate (Hz)	Bit rate (Mbps)	VBV size (Mbits)	MV range (pels)
Simple	Main	720	576	30	15	1.835	-128 ~ 127.5
Main	Low	352	288	30	4	0.489	-64 ~ 63.5
	Main	720	576	30	15	1.835	-128 ~ 127.5
	High 1440	1440	1152	60	60	7.340	-128 ~ 127.5
	High	1920	1152	60	80	9.787	-128 ~ 127.5
SNR scalable	Low	352	288	30	3 (4)	0.367 (0.487)	-64 ~ 63.5
	Main	720	576	30	10 (15)	1.223 (1.835)	-128 ~ 127.5
Spatially scalable	High 1440	720 (1440)	576 (1152)	30 (60)	15 (40) (60)	1.835 (4.893) (7.340)	-128 ~ 127.5
High	Main	352 (720)	288 (576)	30 (30)	4 (15) (20)	0.489 (1.835) (2.447)	-128 ~ 127.5
	High 1440	720 (1440)	576 (1152)	30 (60)	20 (60) (80)	2.447 (7.340) (9.786)	-128 ~ 127.5
	High	960 (1920)	576 (1152)	30 (60)	25 (80) (100)	3.036 (9.787) (12.233)	-128 ~ 127.5

Note: Numbers in parentheses refer to the enhanced layers.

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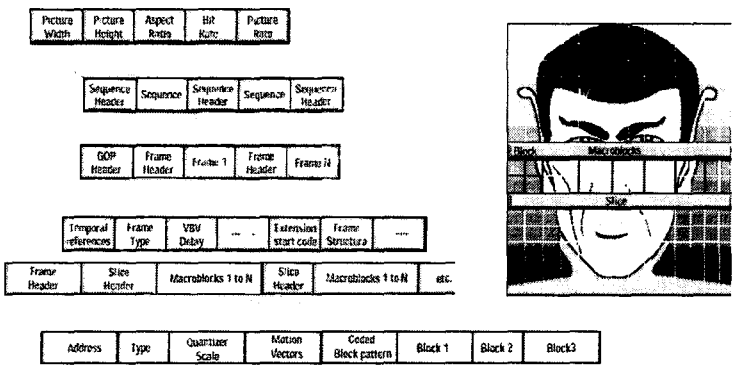
Building the Elementary Stream



- This slide shows how the actual blocks, slices, frames etc. are all put together to form the elementary stream
- Along with the actual picture data, header information is required to reconstruct the I, B, P frames. This header structure is shown.
- The next stage is to take this ES and convert it into something that can be transmitted and decoded at the other end.

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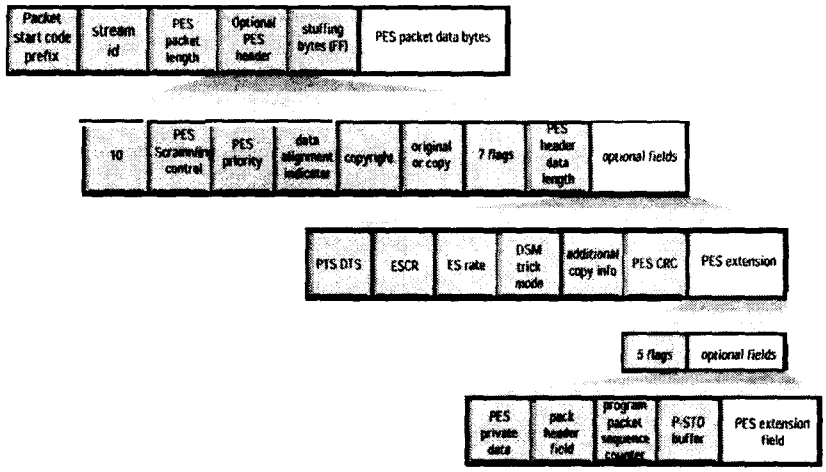
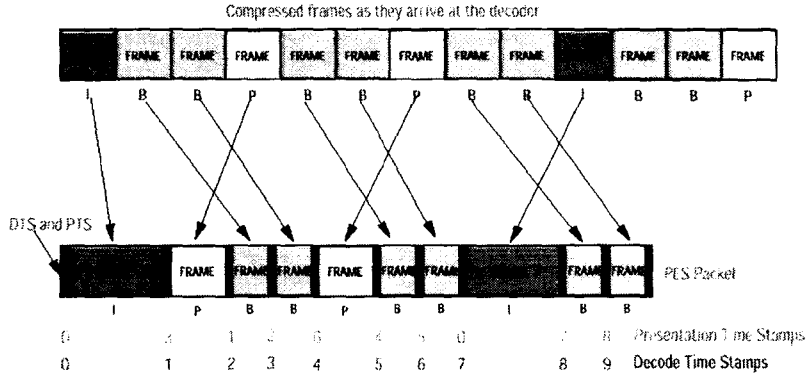
The Packetized Elementary Stream(PES)



Ordering frames for decoding

☐ **The PTS & DTS**



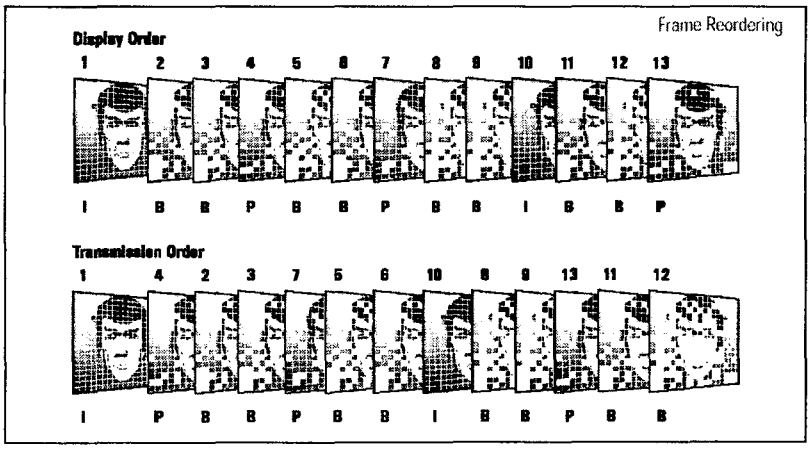
- In odering for a decoder to reconstruct a B-frame from the preceding I and following P frames, both these must arrive first.
- So the order of frame transmission must be different from the order they appear on the TV screen.

Ordering frames for decoding (Cont.)

- The decoder must also know at what time it should show the frames. That is their order in time.
- The Decoding Time Stamp(DTS) :
  tells the decoder when to decode the frame.
- The Presentation Time Stamp(PTS) :
  tells the decoder when to display the frame.
- In addition, a clock must be embedded, to allow a time reference to be created.
- In MPEG-1, the clock is 33 bits with 90 kHz input; while in MPEG-2, the clock is 42 bits with 27 MHz input
- The clock, known as the Programme Clock Reference(PCR), is contained in the Transport Stream(TS). The System Clock Reference(SCR) is used in the Programme Clock Reference(PCR) and in the MPEG-1 system stream.

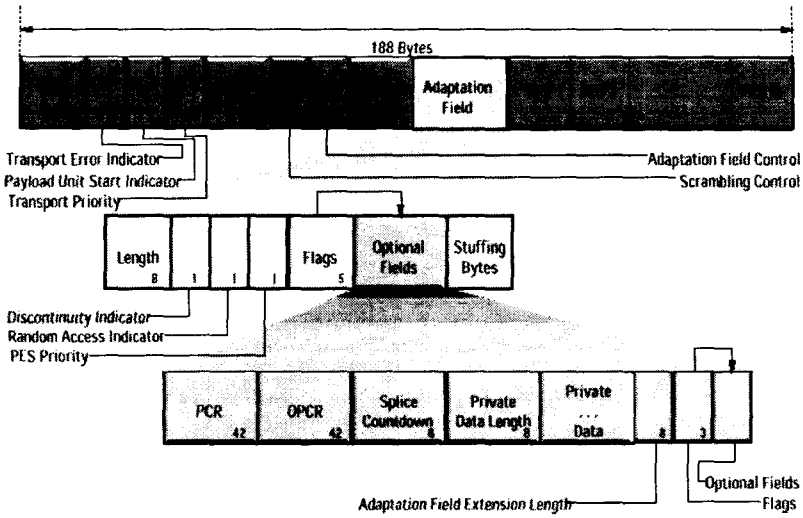
Ordering frames for decoding (Cont.)

☐ **Frame Reordering**



MPEG-2 Transport Stream

☐ **Multiplexing many programs**

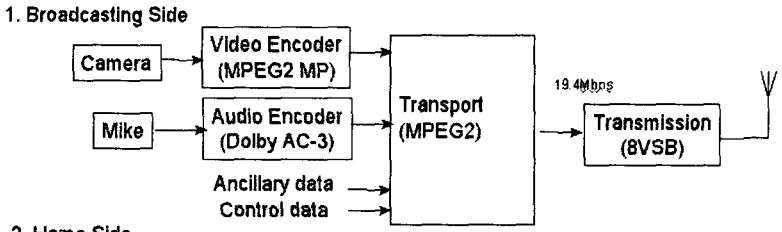


디지털 방송 기술 표준

- 영상 압축: MPEG-2, 30:1 이상 압축
- 음향 압축: MPEG-2(유럽방식)
  Dolby AC-3(미국방식)

- 다중화: MPEG-2
- 에러정정: 길쌈부호 + 리드솔로몬 부호
- 변조(지상파): VSB(미국 방식)
  OFDM(유럽방식)

ATV(Advance TV) 구성도



3. Video Format

Vertical Lines	Pixels	Aspect ratio	Picture rate
1080	1920	16:9	60I,30P,24P
720	1280	16:9	60P,30P,24P
480	704	16:9 and 4:3	60P,60I,30P,24P
480	640	4:3	60P,60I,30P,24P

* Picture rate x 1000/1001도 가능하게

* 최종 규격은 Video Format을 규격에 포함하지 않고 자율에 맡기기로

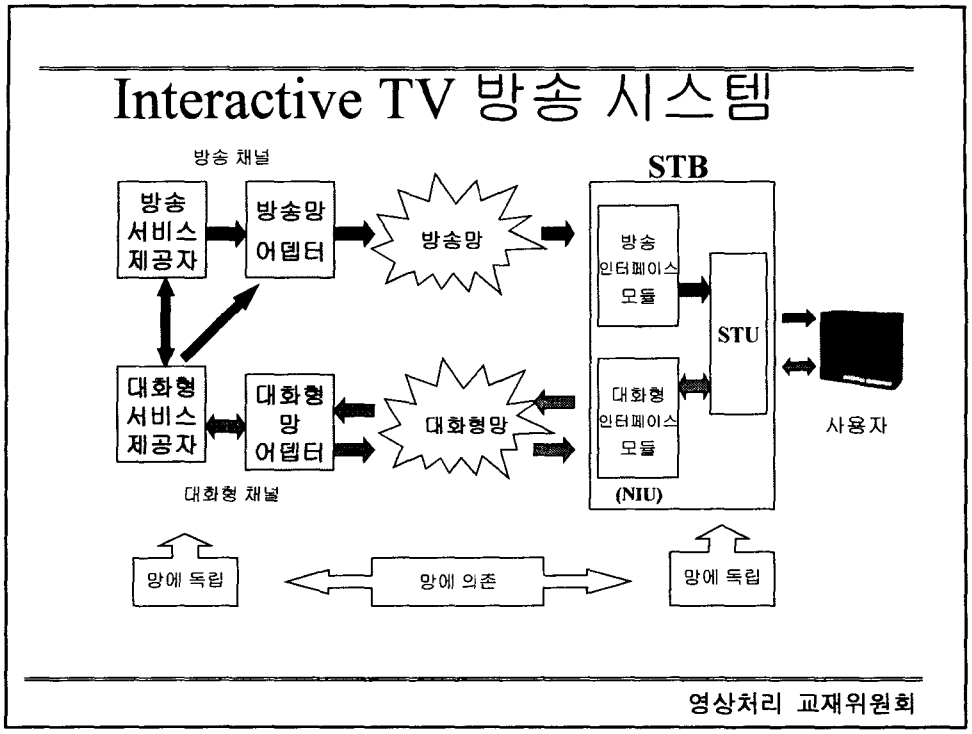
ATSC(The Advanced Television Systems Committee)

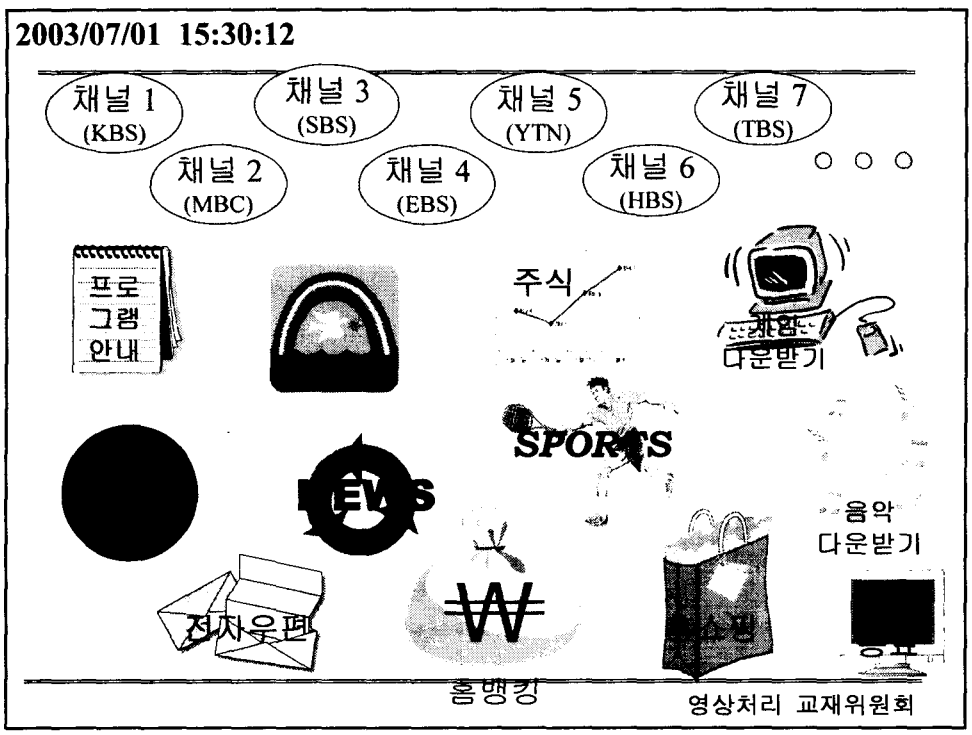
영상처리 교재위원회

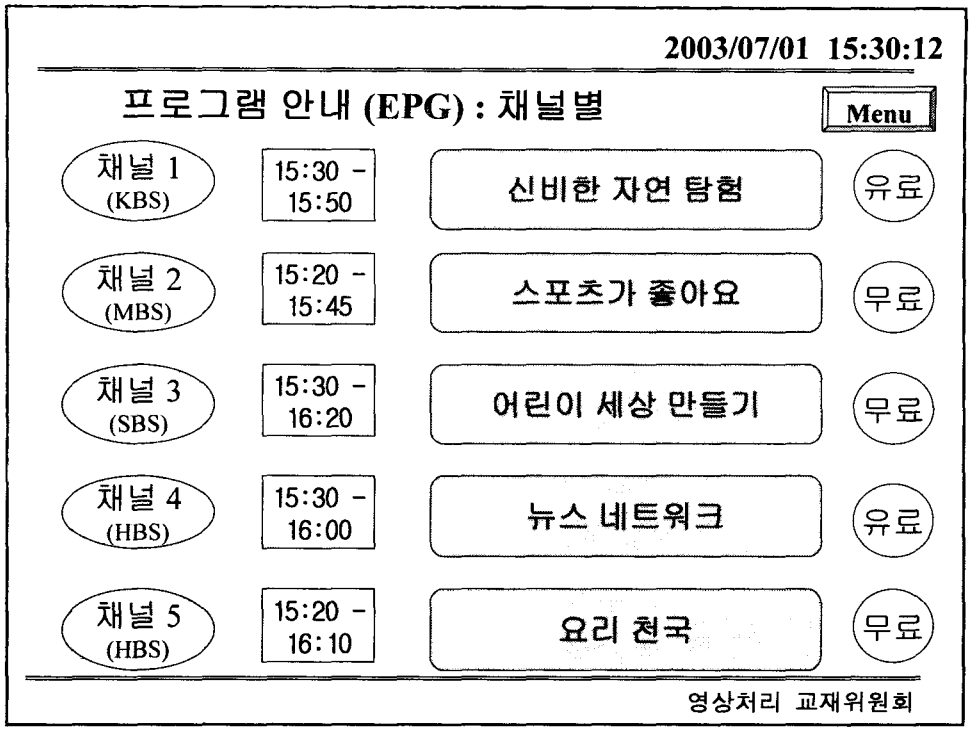
Interactive Digital TV로의 진화

항목 기능	TV	PC	Internet TV	Interactive TV
TV 시청기능	지상파방송 위성방송, CATV 수신	TV Interface B'd 를 이용하여 지상파방송 수신이 가능 품질열화	지상파방송 위성방송, CATV	지상파방송 위성방송,CATV 각종 방송 Data 수신 가능
PC 기능	없음	문서,도표, 그림,대량계산 및 자료관리 복잡한 게임 지원 MPEG-1	없음	단순문서,계산 및 자료관리 제한적인 지장 MPEG-1/2
통신기능	없음	모뎀을 통한 쌍방향 통신 전자우편 및 PC 통신 인터넷,EC,Network Game, 가상교육	외부모뎀(고가)을 통한 쌍방향 통신 전자우편 및 PC 통신 인터넷, 홈쇼핑 등 단순 EC, Network Game,	내장모뎀(저렴)을 통한 쌍방향 통신 UADSL 적용 전자우편 및 PC 통신 인터넷, 홈쇼핑 등 단순 EC, Network Game, 가상교육
가 격 (만 원)	20-80	60-200	50-70	150 이상

영상처리 교재위원회


Interactive TV 방송 시스템
방송 채널
방송
서비스
제공자
방송망
어뎁터
방송망
STB
방송
인터페이스
모듈
STU
대화형
인터페이스
모듈
(NIU)
사용자
대화형
서비스
제공자
대화형
망
어뎁터
대화형망
대화형 채널
망에 독립
망에 의존
망에 독립
영상처리 교재위원회


2003/07/01 15:30:12
채널 1
(KBS)
채널 3
(SBS)
채널 5
(YTN)
채널 7
(TBS)
채널 2
(MBC)
채널 4
(EBS)
채널 6
(HBS)
프로
그램
안내
주식
SPORTS
음악
다운받기
전자우편
홈뱅킹
영상처리 교재위원회


2003/07/01 15:30:12
프로그램 안내 (EPG) : 채널별
Menu
채널 1 (KBS)
15:30 - 15:50
신비한 자연 탐험
유료
채널 2 (MBS)
15:20 - 15:45
스포츠가 좋아요
무료
채널 3 (SBS)
15:30 - 16:20
어린이 세상 만들기
무료
채널 4 (HBS)
15:30 - 16:00
뉴스 네트워크
유료
채널 5 (HBS)
15:20 - 16:10
요리 천국
무료
영상처리 교재위원회


1999/07/02 17:10:25
프로그램 안내 (EPG) : 시간대별
시 간
프로그램 제목
예약 선택
17:00 - 17:30
네트워크 뉴스
17:30 - 18:00
어린이 명작만화
18:00 - 19:00
신나는 세계 여행
예약녹화
19:00 - 20:20
집 중 토 론 광 장
20:20 - 21:00
일일 연속극
예약녹화
21:00 - 21:50
9시 뉴스
예약녹화
21:50 - 22:10
스포츠 뉴스
22:10 - 23:00
베스트셀러 극장
예약녹화
신나는 세계 여행
녹화가 예약되었습니다
영상처리 교재위원회

2003. 6. 29. 오후 17:10 현재

오늘의 주요 뉴스

- ↗ 내년 공공 근로사업 절반 규모로 축소
- ↗ 지하철 8호선 내달 2일 완전 개통
- ↗ 금융 피라미드로 128억 사기 5명 영장
- ↗ 인터넷 상거래, 2003년 1조 달러 성장
- ↗ 경주에서 청동기 주거지 무더기 발견

영상처리 교재위원회

2003. 6. 29. 오후 17:10 현재

Sports Score Board

◇프로야구 중간순위(29일)

스드림리그

순위	팀	승-패-무	승률	승차
1	롯데	44-25-4	0.638	-
2	두산	40-30-4	0.571	4.5
3	현대	38-30-5	0.545	6.5
4	해태	34-36-2	0.486	10.5

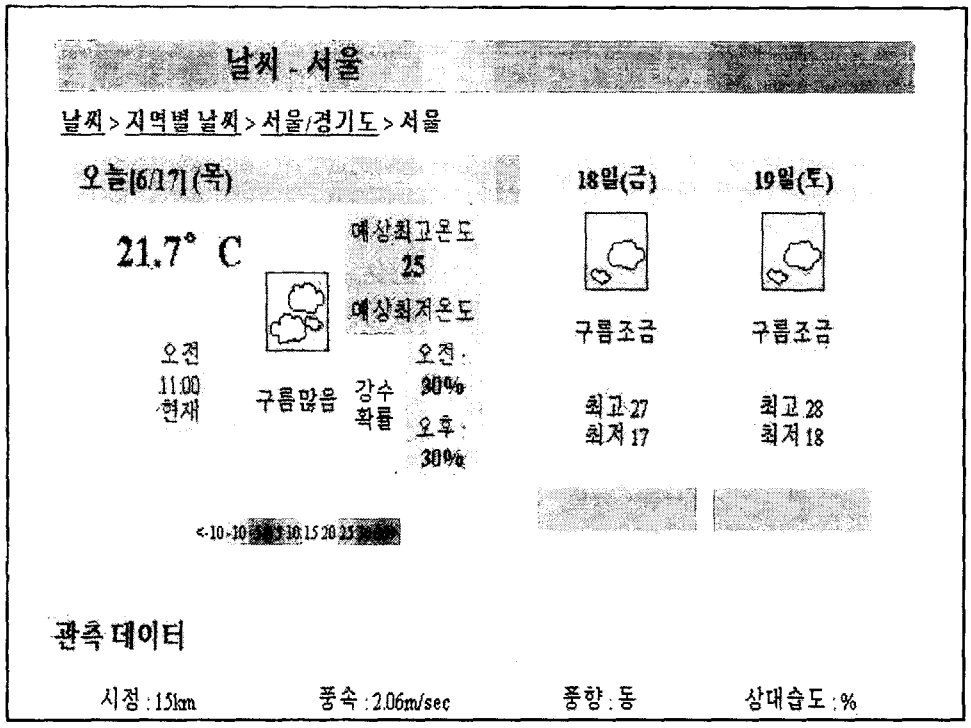
스미직리그

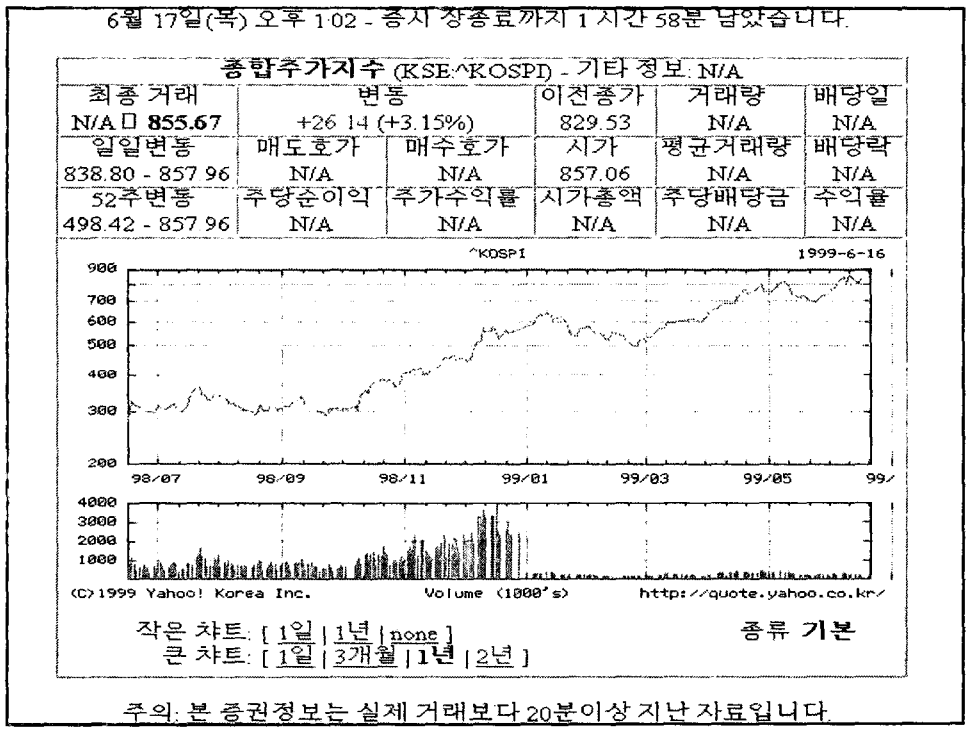
순위	팀	승-패-무	승률	승차
1	삼성	39-33-2	0.542	-
2	LG	37-35-0	0.514	2.0
3	한화	34-37-2	0.479	4.5
4	쌍방울	15-53-5	0.221	22.0

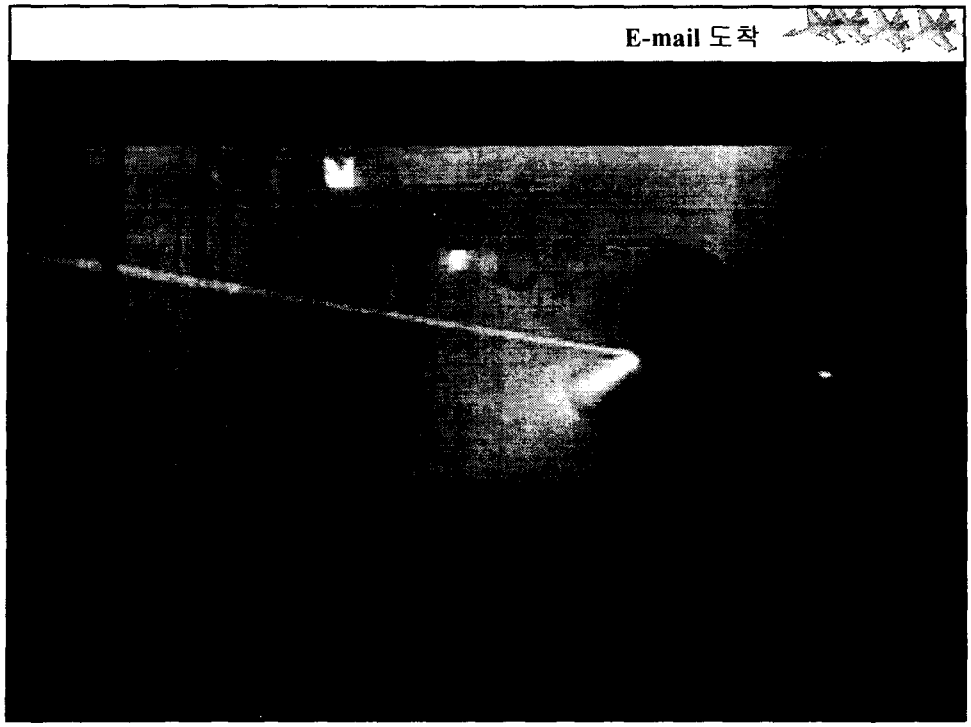
◇ 99 베이코리아컵 K-리그(28일)

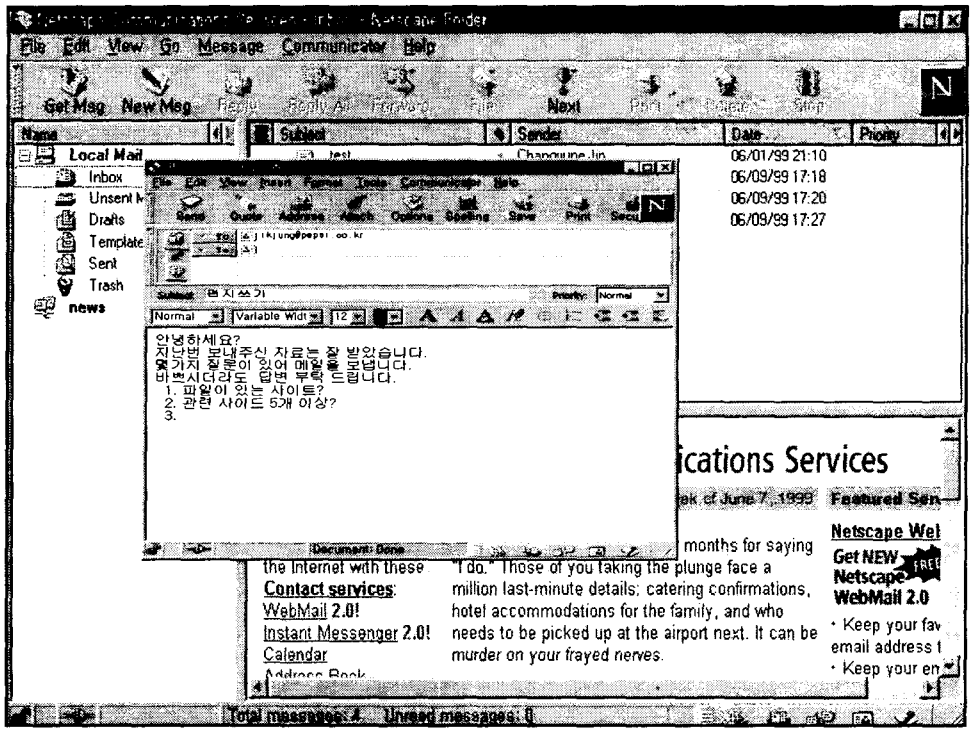
순위	팀	승점	승	패	득	실	차
1	SK	11	4(3-1-0)	0	7	1	+6
2	삼성	9	3(3-0-0)	1	4	3	+1
3	대우	8	3(2-1-0)	2	7	7	0
4	일화	7	3(2-0-1)	2	5	7	-2
5	현대	6	2(2-0-0)	2	4	3	+1
6	전남	6	2(2-0-0)	2	5	5	0
7	전북	4	2(1-0-1)	2	6	6	0
8	LG	4	2(1-0-1)	3	3	4	-1
9	대전	3	1(1-0-0)	4	6	8	-2
10	포항	0	0(0-0-0)	4	3	6	-3

※괄호안 (정규-연장-PK)


날씨 - 서울
날씨 > 지역별 날씨 > 서울/경기도 > 서울
오늘[6/17](목)
21.7° C
오전 11:00 현재
구름많음
예상최고온도 25
예상최저온도
강수 확률
오전 : 90%
오후 : 30%
18일(금)
구름조금
최고 27
최저 17
19일(토)
구름조금
최고 28
최저 18
관측 데이터
시정 : 15km
풍속 : 2.06m/sec
풍향 : 동
상대습도 : %


6월 17일(목) 오후 1:02 - 증시 장종료까지 1 시간 58분 남았습니다.
종합주가지수 (KSE:^KOSPI) - 기타 정보: N/A
최종 거래 N/A 미 855.67
변동 +26.14 (+3.15%)
이전종가 829.53
거래량 N/A
배당일 N/A
일일변동 838.80 - 857.96
매도호가 N/A
매수호가 N/A
시가 857.06
평균거래량 N/A
배당락 N/A
52주변동 498.42 - 857.96
주당순이익 N/A
주가수익률 N/A
시가총액 N/A
주당배당금 N/A
주익율 N/A
^KOSPI
1999-6-16
900
700
600
500
400
300
200
98/07
98/09
98/11
99/01
99/03
99/05
4000
3000
2000
1000
(C)1999 Yahoo! Korea Inc.
Volume (1000's)
http://quote.yahoo.co.kr/
작은 차트: [1일 | 1년 | none]
큰 차트: [1일 | 3개월 | 1년 | 2년]
종류 기본
주의: 본 증권정보는 실제 거래보다 20분이상 지난 자료입니다.


E-mail 도착


File Edit View Go Message Communicator Help
Get Msg New Msg Next
Local Mail
Inbox
Drafts
Template
Sent
Trash
news
Subject Sender Date Priority
06/01/99 21:10
06/09/99 17:18
06/09/99 17:20
06/09/99 17:27
안녕하세요?
지난번 보내주신 자료는 잘 받았습니다.
몇가지 질문이 있어 메일을 보냅니다.
바쁘시더라도 답변 부탁 드립니다.
1. 파일이 있는 사이트?
2. 관련 사이트 5개 이상?
3.
Contact services:
WebMail 2.0!
Instant Messenger 2.0!
Calendar
months for saying
"I do." Those of you taking the plunge face a million last-minute details; catering confirmations, hotel accommodations for the family, and who needs to be picked up at the airport next. It can be murder on your frayed nerves.
Netscape Wel
Get NEW Netscape WebMail 2.0
Keep your fav
email address t
Keep your en
Total messages: 4 Unread messages: 0

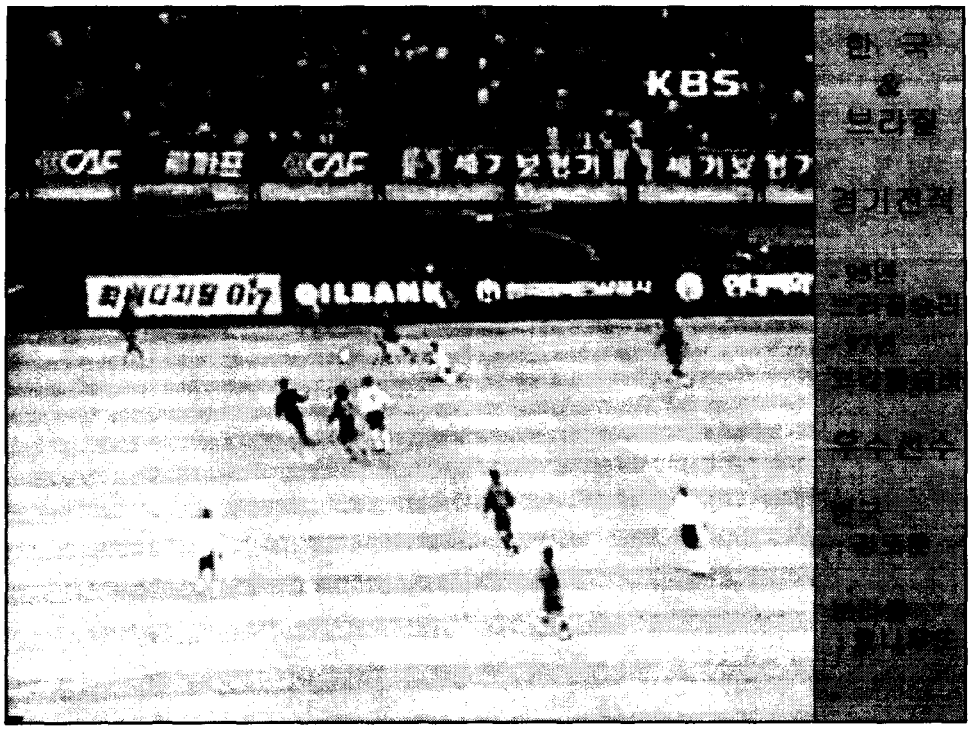
넥타이세트(6매)
제조원 :
회원가 : 39,900원

구매하기

관련품목 손수건/스타킹/양말 / 우산/장갑/머플러/스카프 /

-재질 : POLYESTER 100%
-규격 : 폭 950mm, 길이 1,450mm
-특징
1. 폴리에스테르는 넥타이에 사용되고 있는 화학섬유 중 대표적인 것이다.
2. 탄력성이 풍부하고, 주름이 생기지 않는다.
3. 가볍고 형태보존이 강하다.
4. 특수가공 처리로 인하여 실크와 비슷한 촉감과 광택을 가지고 있다.
5. 실질적인 소비감소와 물가급등에 따른 합리적이고 현실적인 가격 경쟁력에서 유리하다.

pop (PC)	**Admiral: Sea Battles** Fight for control of the oceans	10/18/96	160261
pop pick (PC)	**Age of Empires** Advance an enti… strategy game	10/2/97	795138
pop pick (PC)	**Age of Empi… Rise of Rom…** Build an empire… Roman times.	…6/98	403383
pop (PC)	**Age of Sail 1** Participate in e… combat	…/97	144433
pop (PC)	**Align It** Align five balls … before the screen fills up	…7/98	8865
pop (PC)	**Alive Again: WaveCatcher 1.0** Play an online multiplayer strategy game in an alien world	1/23/99	6519



주인공 소개

- 세익스피어 역 - 조셉 파인즈, 영화 '엘리자베스'에 출연
- 바이올라 역 - 기네스 펠트로, '엠마', '위대한 유산' 에 출연

주제가 소개

' When I dream ' -- Carol kidd

영국 재즈가수 캐롤 키드의 히트곡, Linn Record에서 발매

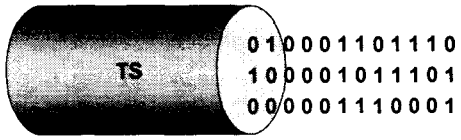
DVB Data Broadcasting

- Data Piping
- Asynchronous Data Streaming
- Synchronous and Synchronized Data Streaming
- Multi-protocol Encapsulation
- Data Carousels

영상처리 교재위원회

DVB Data Broadcasting

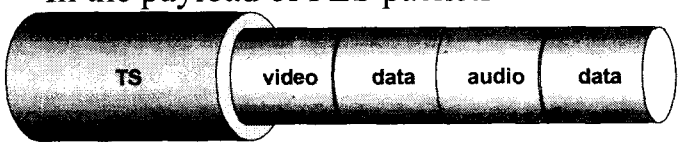
- Data Piping
  - in the payload of MPEG-2 TS packets




```
Data_broadcast_descriptor(){
data_broadcast_id  = 0x01
component_tag      = component_tag of stream_identifier_descriptor at PMT
selector_length    = 0x00
selector_byte      = not present
}
```


DVB Data Broadcasting

- Asynchronous data streaming
  - In the payload of PES packets

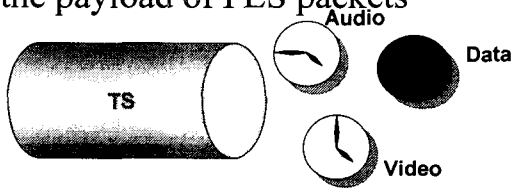



```
In PES packet Header
stream_id = 0xBF
PES_packet_length = non-zero
```

```
Data_broadcast_descriptor(){
data_broadcast_id  = 0x02
component_tag      = component_tag of stream_identifier_descriptor at PMT
selector_length    = 0x00
selector_byte      = not present
}
```

DVB Data Broadcasting

- Synchronous and synchronized data streaming
  - In the payload of PES packets

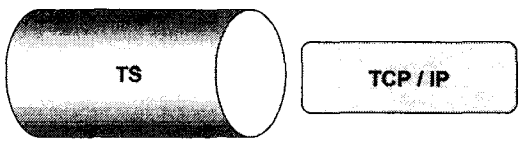



```
Data_broadcast_descriptor(){
data_broadcast_id  = 0x03(synchronous) , 0x04(synchronized)
component_tag      = component_tag of stream_identifier_descriptor at PMT
selector_length    = 0x00
selector_byte      = not present
}
```

영상처리 교재위원회

DVB Data Broadcasting

- Multi-protocol encapsulation
  - Using datagram_section

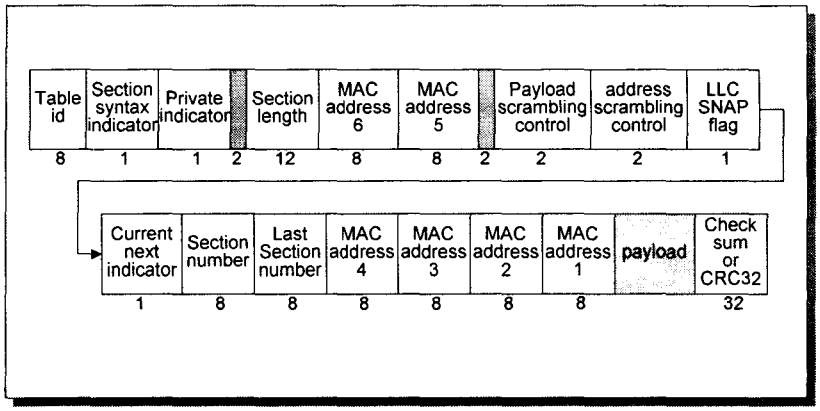



```
Data_broadcast_descriptor(){
data_broadcast_id  = 0x05
component_tag      = component_tag of stream_identifier_descriptor at PMT
selector_length    = 0x02
selector_byte      = convey the multiprotocol_encapsulation_info structure
}
```

영상처리 교재위원회

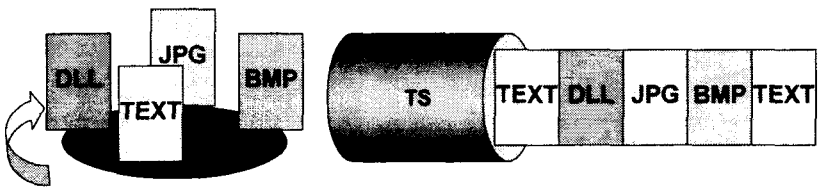
DVB Data Broadcasting

- Datagram_section



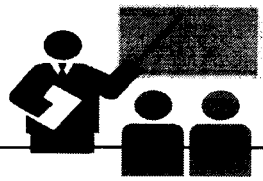
DVB Data Broadcasting

- Data Carousel
  - Using DSMCC_section




```
Data_broadcast_descriptor(){
data_broadcast_id  = 0x06
component_tag      = component_tag of stream_identifier_descriptor at PMT
selector_length    = 0x10
selector_byte      = convey the data_carousel_info structure
}
```

결 론



- 21C 디지털 정보 혁명
  Interactive Digital TV +
  초고속통신망(유선) + IMT2000 (무선)
- Towards Interactive Digital TV
  - Digital Audio/Video Broadcasting
  - One-Way Data Broadcasting
  - Two-Way Interactive Broadcasting
- 방송, 통신, 컴퓨터, 가전의 융합 기술
- 북미와 유럽의 표준화 동향 주시