

The New MPEGs

What are they, and do they matter?

Peter Symes, Grass Valley Group

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In the Beginning

- MPEG-1
 - Developed 1988-1992
 - CIF (352x240) @ 30 Hz
 - Up to 1.5 Mb/s Video + Audio (1x CD rate)
 - Compare to audio CD, 2ch x 16 bits @ 44.1kHz
 - Better than 20:1 compression
 - Used DCT for spatial compression (similar to JPEG)
 - Motion estimation & compensation
 - No interlace tools
 - Defined tools, syntax & decoder (NOT the encoder)
 - Powerful syntax, extended for use with SDTV & HDTV for DirecTV and AD-HDTV (special decoders)

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MPEG-1 Begat MPEG-2

- MPEG-2: Developed 1991-1994 (and continuing)
- Initially intended for broadcast TV (standard definition)
 - Improvements, but same basic algorithms as MPEG-1 for spatial and temporal compression (NOT a given!)
 - Tools for interlace
 - Scalable syntax
 - System layer for multiple program streams
 - Profiles & Levels
 - Vastly increased flexibility, including HDTV
 - Complexity/cost can be matched to application
 - Permitted addition of later extensions (4:2:2 profile etc.)

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Profiles & Levels in MPEG-2

HIGH		4:2:0 1920 x 1152 80 Mb/s I, P, B	4:2:2 1920 x 1080 300 Mb/s I, P, B			4:2:0, 4:2:2 1920 x 1152 100 Mb/s I, P, B
	HIGH-1440	4:2:0 1440 x 1152 60 Mb/s I, P, B			4:2:0 1440 x 1152 60 Mb/s I, P, B	4:2:0, 4:2:2 1440 x 1152 80 Mb/s I, P, B
MAIN	4:2:0 720 x 576 15 Mb/s I, P	4:2:0 720 x 576 15 Mb/s I, P, B	4:2:2 720 x 608 50 Mb/s I, P, B	4:2:0 720 x 576 15 Mb/s I, P, B		4:2:0, 4:2:2 720 x 576 20 Mb/s I, P, B
	LOW	4:2:0 352 x 288 4 Mb/s I, P, B		4:2:0 352 x 288 4 Mb/s I, P, B		
LEVEL			4:2:2			
PROFILE	SIMPLE	MAIN	PROFILE	SNR	SPATIAL	HIGH

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And on the Third MPEG, Leonardo Rested

- MPEG-3
 - Started 1992 to provide HDTV capabilities (1920x1080 @ 30 Hz; 20-40 Mb/s)
 - Abandoned in 1993 when it was realized that MPEG-2 would do the job!

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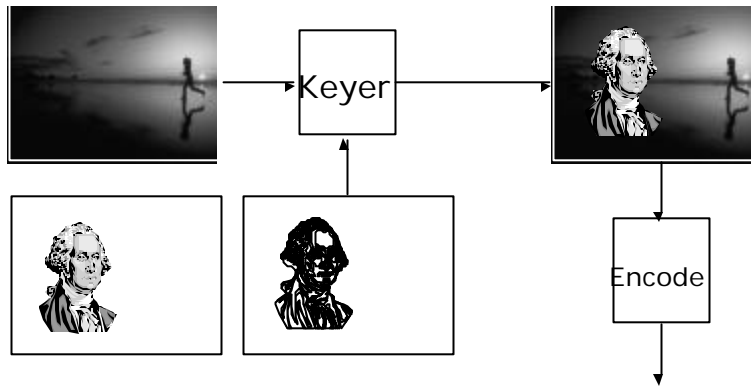
And Then There Was MPEG-4

- Started 1993
 - Initial focus—"Very low bit rate audiovisual coding"
 - Below 64 kb/s
 - 64 to 384 kb/s
 - 384 kb/s to 4 Mb/s
- Changed in 1994 to "Coding of Audiovisual Objects"
- Evolved into "something for everyone"

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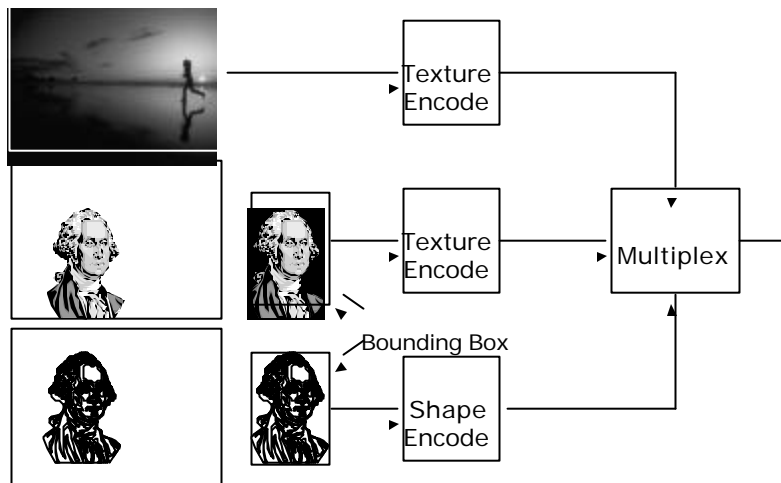
Conventional Coding (Compositing First)



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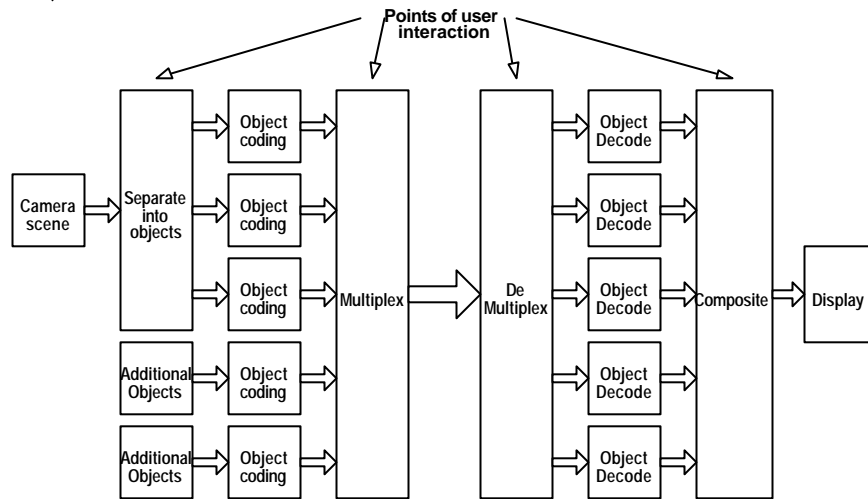
Object Coding



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Object Coding in MPEG-4



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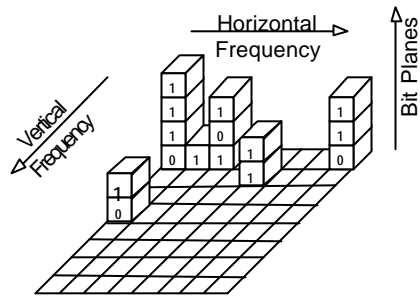
Types of Objects

- Video Objects
 - Natural and/or synthetic
 - Backgrounds
 - Sprites
 - Other "video" components (foreground objects etc.)
 - Text
 - Graphic elements (2-D & 3-D)
 - Facial animations
 - Body animations
- Audio Objects
 - Natural & Synthetic
- Data Objects

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Fine Grain Scalability



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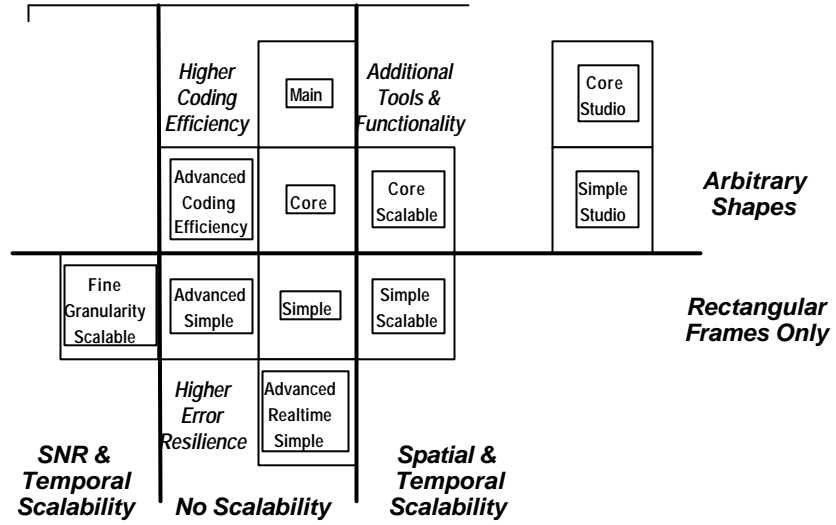
Applications of MPEG-4

- Games
- Games
- Games
- Internet streaming
- Almost anything else
- MPEG-4 is vast, and getting even bigger!

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Video Profiles in MPEG-4



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MPEG-7

- Why "7" ???
 - 1, 2, ~~3~~, 4, 5, ...
 - 1, 2, 4, 8, ...
 - 1, 2, 4, 7, ...

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MPEG-7 is NOT About Compression

- MPEG-7 is about describing digital objects
- MPEG-7 is about *metadata*
 - The content (video, audio, etc.) is called digital *essence*
 - Metadata is data that *describes* digital essence
 - The “bits about the bits”
 - Title, owner, actors, format, color-space, ...
 - Shooting location, time, zoom angle, ...
 - Names, events, transcripts, ...
 - Objects, faces, ...
 - Colors, textures, shapes, ...

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The Archive Dilemma

- “Once the journalist who worked on the story has forgotten what footage is on what tape, the archive is practically valueless.”
- Meaningful availability is timely availability
- Computer Systems Offer Excellent Search Tools
- But what do we search?

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Some Example Applications

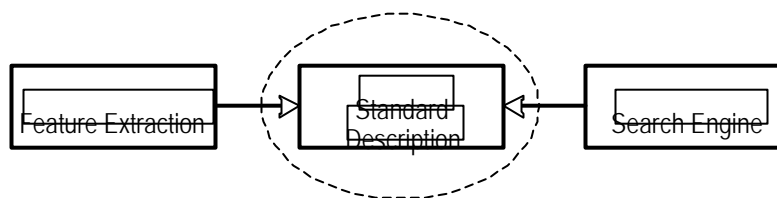
- Music: Play a few notes on a keyboard and get in return a list of musical pieces containing (or close to) the required tune or images somehow matching the notes, e.g. in terms of emotions.
- Graphics: Draw a few lines on a screen and get in return a set of images containing similar graphics, logos, ideograms, ...
- Find all clips on record showing both Liz Taylor and Richard Burton

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Scope of MPEG-7

The technology will come!



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MPEG-21

- "21" ???!!
 - Never mind!
- MPEG-21 seeks to create a complete structure for the management and use of digital assets, including all the infrastructure support for the commercial transactions that must accompany this structure.
- Vision Statement: "to enable transparent and augmented use of multimedia resources across a wide range of networks and devices"

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Elements of MPEG-21

- Digital item declaration
- Digital item representation
- Digital item identification and description
- Content management and usage
- Intellectual property management and protection
- Terminals and networks
- Event reporting

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Conclusions

- The deployment of millions of MPEG-2 decoders (DVD players, digital TVs, etc.) Will ensure the continued relevance of MPEG-2
- MPEG-4 Will become a major force in the computer world, and may appear in set-top boxes, etc. Don't ignore it!
- MPEG-7 should become a vital tool in the use of digital assets
- MPEG-21—Let's find out what it really is first (but MPEG has an enviable track record!)

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Finally ...

- Presentation available at www.symes.tv

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