



MPEG-4 and MPEG-7

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Outline

- The MPEG-4 standard
- Why MPEG-4
- MPEG-4 System
- Video Coding
- Audio Coding
- MPEG-7



MPEG-4 Standard

- Created by Motion Picture Experts Group, a working group of ISO/IEC
- Started in 1995
- International Standard in 1999
- Version 2 International Standard in 2000



MPEG-1, MPEG-2, MHEG-5

- MPEG-1: a standard for compressed digital video, bit rates 1,5Mbits/s
- MPEG-2: a family of compression profiles and levels up to HDTV
- MHEG-5: extended multimedia and interaction functionality

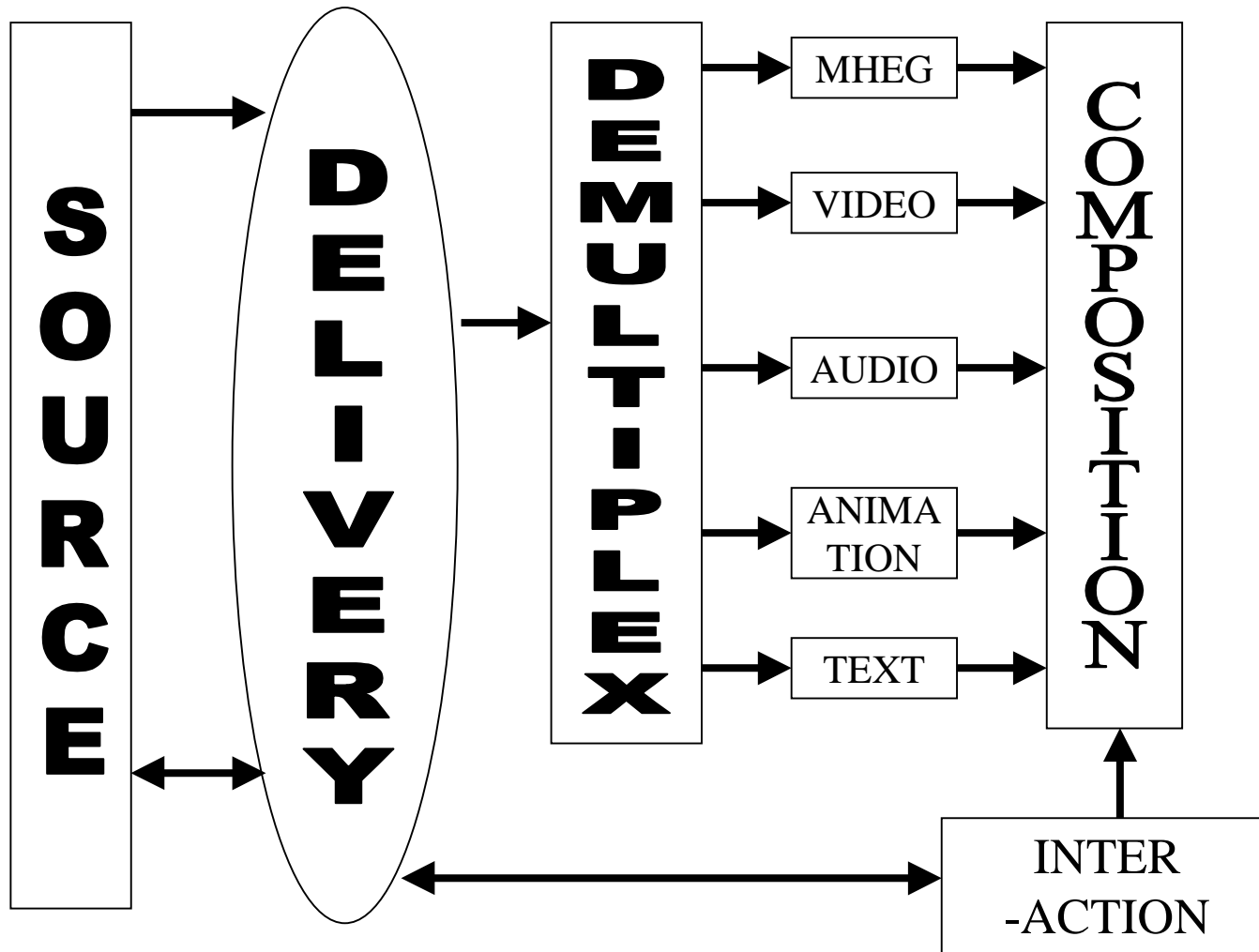


MPEG-4

- MPEG-4 defines coding of all types of multimedia information
- 1) allows more interaction by the user
- 2) includes some new video compression methods
- 3) includes methods for audio and voice encoding
- 4) scalable
- 5) object based, allows scenes to be composed of natural and synthetic objects
- Very different from MPEG-1&2, more than MHEG-5

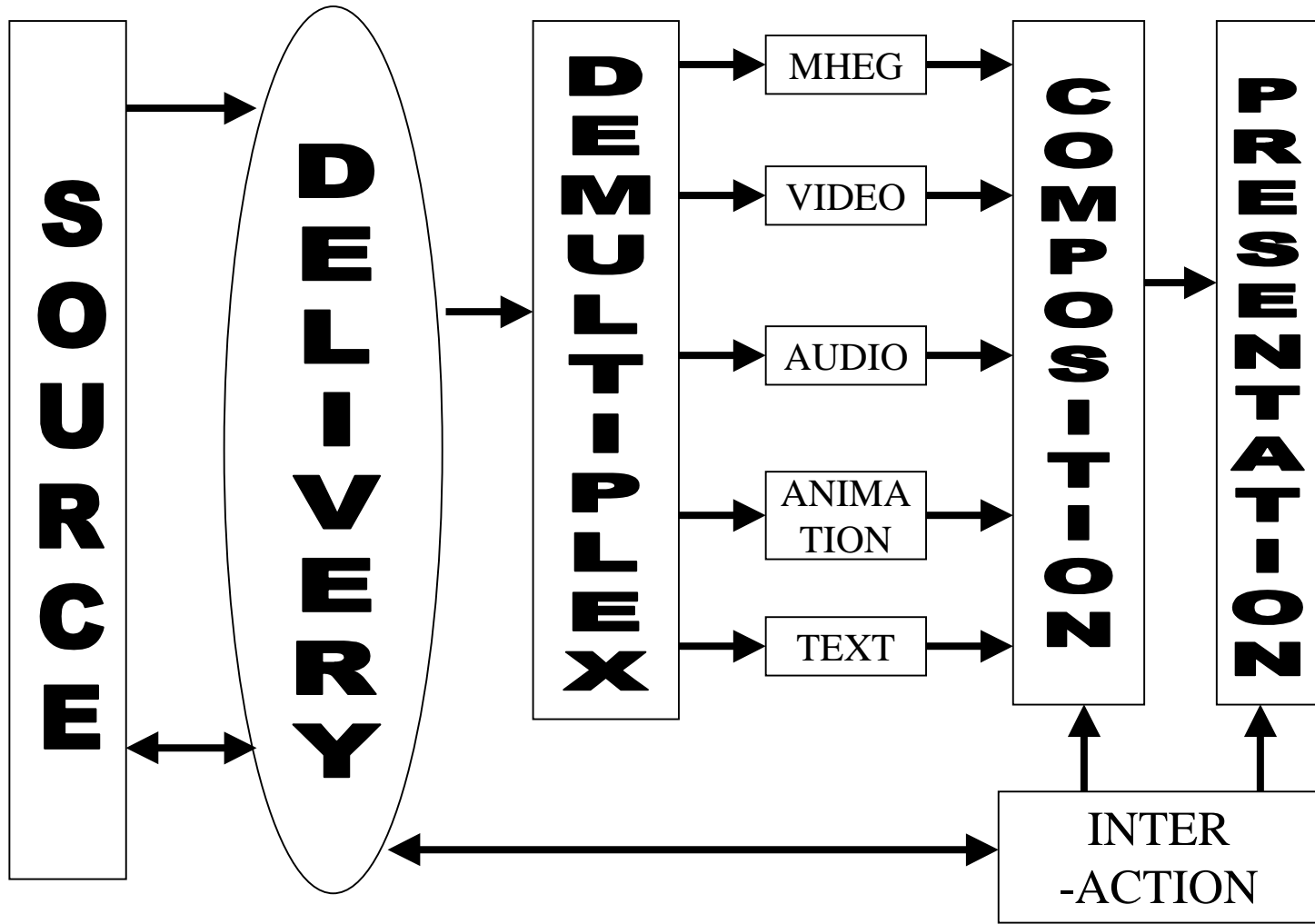


MHEG-5 enabled MPEG-2





MPEG-4





Why MPEG4

- Mpeg-1&2 are used well beyond their intended scope
- New areas where a/v content is needed
- Communications, computing and entertainment are constantly converging
- Target of MPEG-4
 - to prevent proprietary standards
 - to supply uniform (and top-level) a/v encoders and decoders
 - to act as frame work for different kinds of a/v content and viewers



Why MPEG-4

- Goals of MPEG-4
 - reusable and reconfigurable content
 - synthetic and natural content combined
 - high level of user interaction
 - scalability
 - content-based Qos

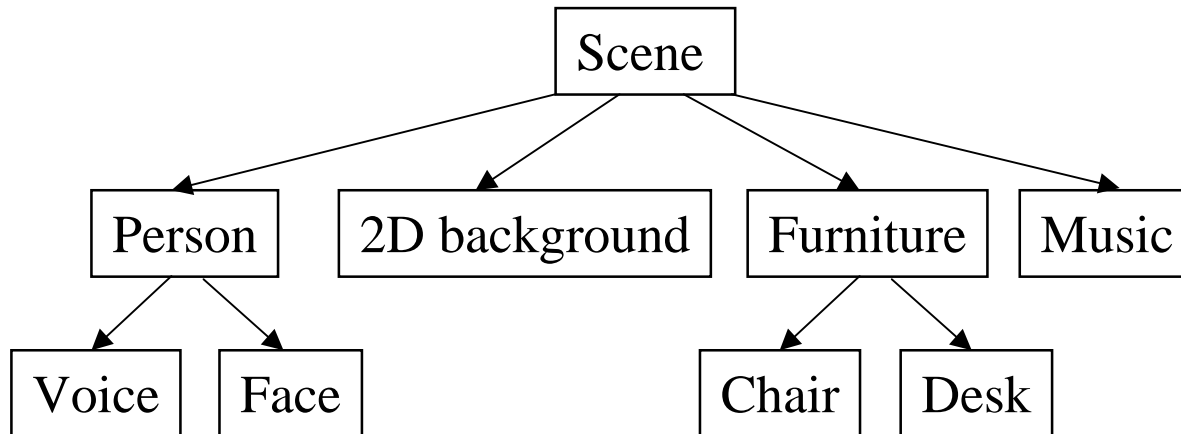


MPEG-4 Systems: Objects

- A scene consists of audio-visual objects (AVOs)
- Objects can be natural (images, video, voice) or synthetic (text, animation, video)
- Objects are given a position in 2-D or 3-D space
- Objects can be encoded and decoded separately
 - > much better compression rates and different quality
- Objects can be dynamically added and removed
 - > new kind of scalability
- Objects can be dynamically moved, changed and created



MPEG-4 Systems: scene





MPEG-4 Systems: BIFS

- Binary Format for Scenes
- A language for describing and dynamically changing the scene
- Used for scene description (SD)
- Binary and compressed
- Closely related to VRML - unlike VRML is real-time streaming (doesn't need to fully loaded but can be built up in the fly)

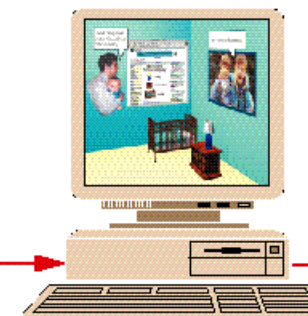


Objects and data streams

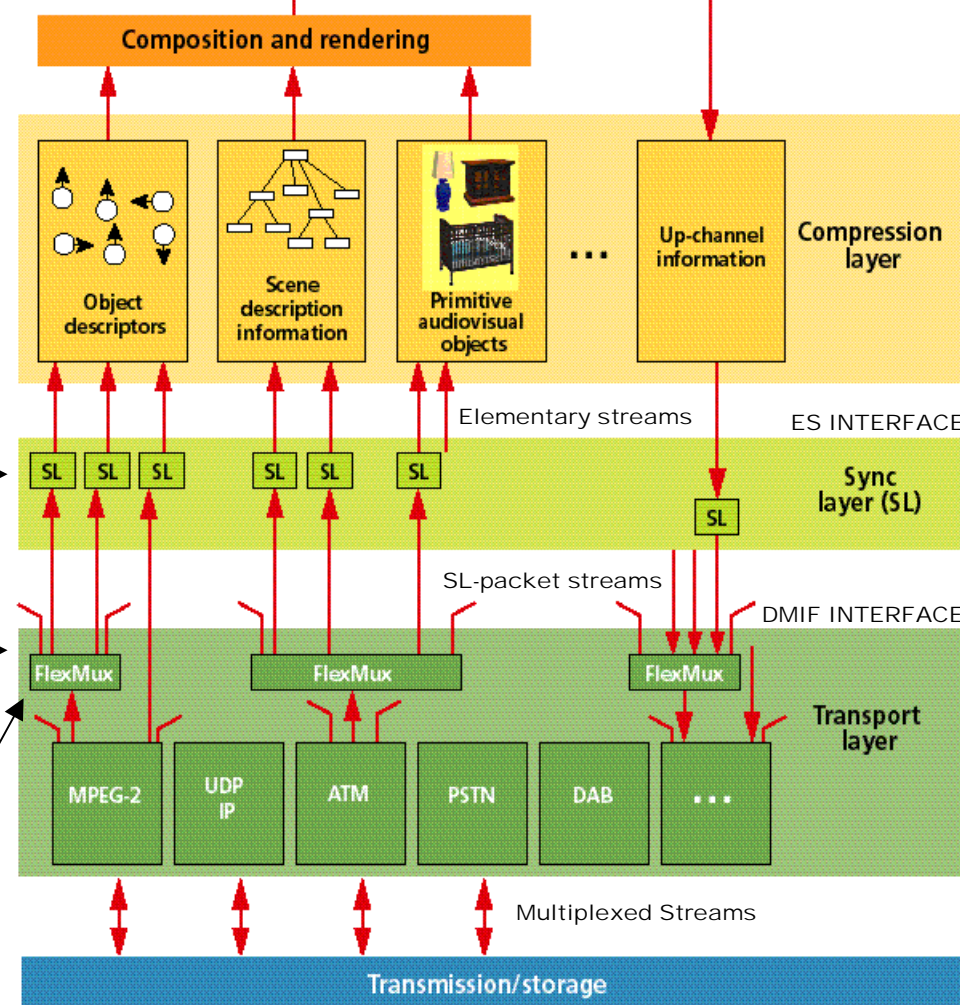
- Objects are placed in Elementary Streams (ES)
- BIFS is transmitted in its own stream
- BIFS contains pointers to AVO streams
- Object Descriptors (OD) are used to identify objects
- ODs contain Elementary Stream Descriptors (ESD) to identify necessary decoders



System Decoder Model



Interactive audiovisual scene



Synchronization Layer
 -coordinates play-out of multiple objects
 -sl-packets contain timing/synchronization information

Delivery Multimedia Integration Framework
 -provides single interface to network or storage
 -isolates MPEG4 from delivery layer details
 -decouples apps from delivery technologies and standards

FlexMux tool provides interfacing with systems with otherkind of multiplexing or no multiplexing



MPEG-4 Natural Video Coding

- MPEG4 targets a wide range of av apps (from Digital TV to mobile multimedia)
- Provides interface points to existing systems
- Progressive and interlaced video formats
- Originally targeted for three bit-rate ranges:
 - < 64Kbit/s
 - 64 - 384 Kbit/s
 - 384kbit - 4Mbit/s
- Also higher bit-rates are supported



Natural Video Coding

- Improved compression efficiency over MPEG-1&2
- Contains features needed in low bit-rate systems:
 - error resilience
 - unequal error protection
 - selectable object update rates
 - temporal and spatial scalability



Audio and Speech Coding

- Several different audio and speech encoding methods
- Audio is also represented as objects that can be dynamically edited
- Audio objects may be given a location in 3-D space
- Environmental spatialization



Natural audio coding

- MPEG-4 audio tool is compatible with MPEG-2's Advanced Audio Coding (AAC)
- Target bit-rates:
 - 16Kbit/s for AM-radio quality
 - 64Kbit/s for transparent quality
- Now, bit-rates are considerably lower than in MP3



Natural speech coding

Harmonic Vector Excitation Coder (HVXC)

- handles operation at 2 and 4Kbit/s
- sampling frequency 8KHz
- bandwidth 300-3400Hz

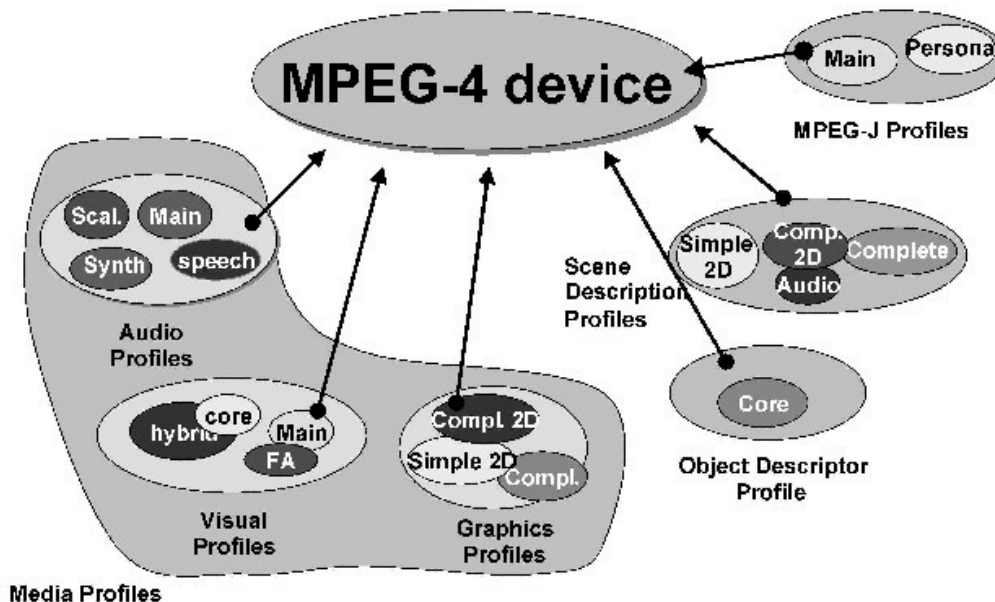
Code-Excited Linear Predictive Coder (CELP)

- 4-24Kbit/s
- Sampling frequency 8khz or 16khz
- bandwidth 50-7000Hz
- bit-rate scalability of 200 bit/s



MPEG-4 Profiles

- The standard only defines the method of decoding, not encoding
- A MPEG-4 decoder doesn't have to be able to decode all MPEG-4 tools
 - profiles are used to identify and group different parts of the standard





MPEG-4 example

- Microsoft Media Player can read and write video content in
 - ISO MPEG-4 video codec version 1.0
 - Microsoft MPEG-4 version 3 codec
- It can also read MPEG-4 version 2.
- DivX;) and DivX4 codecs are supposed to be fully MPEG-4 version 1 compliant.



MPEG 7

- Started in 1999
- International standard in 2001
- Formally called ‘Multimedia Content Description Interface’.
- A standard for describing the multimedia content data "that supports some degree of interpretation of the information's meaning, which can be passed onto, or accessed by, a device or a computer code."
- Application examples:
 - digital libraries, multimedia directories, broadcast media selection

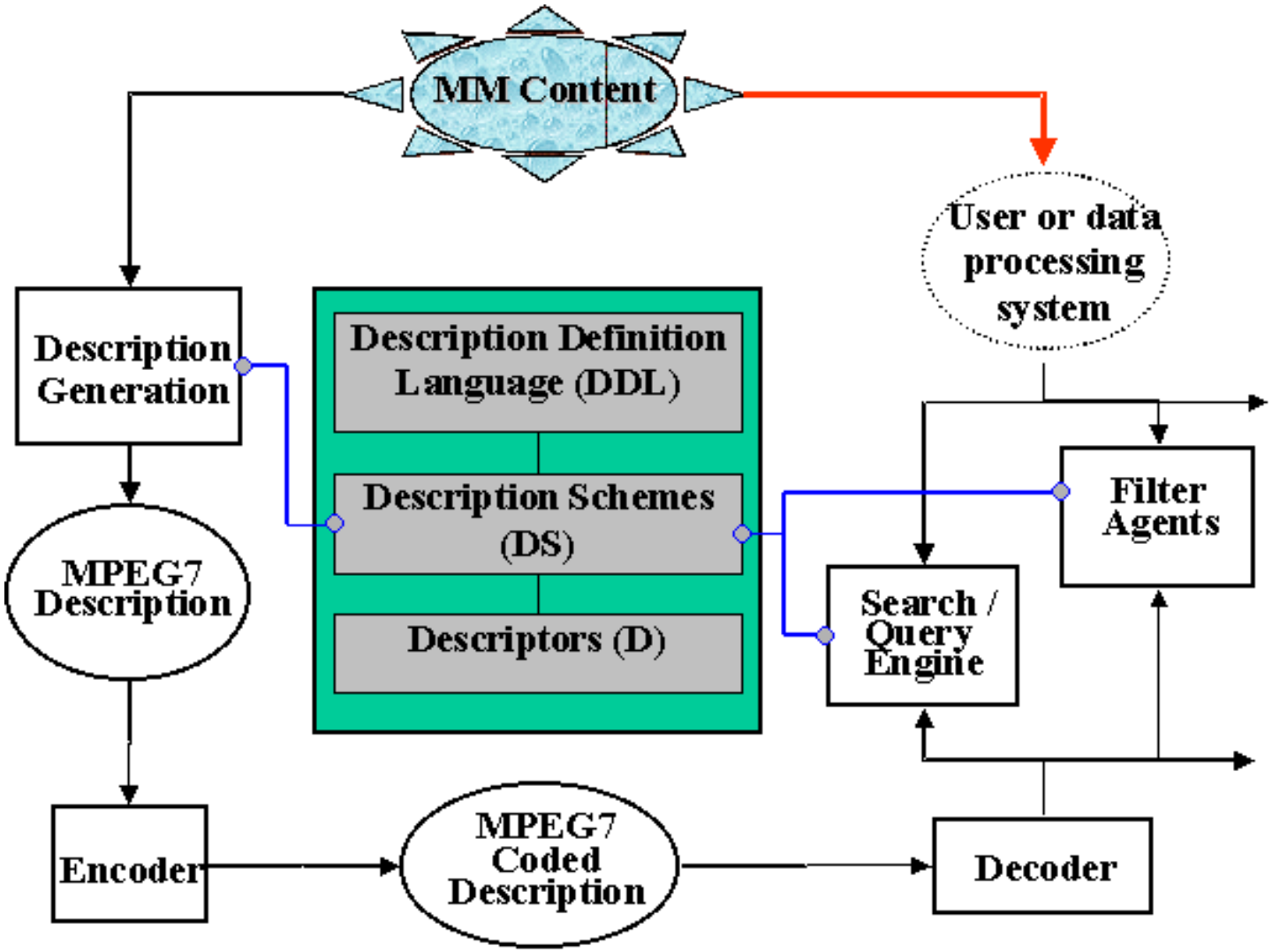


MPEG 7

- Standard specifies
 - a set of descriptors
 - a set of description schemes (DS)
 - A language to specify description schemes (description definition language DDL)
- Only specifies the format of the descriptions, no algorithms.



MPEG 7





Summary

MPEG-4

- A frame work for all kind of multimedia data
- Object based, reusable and reconfigurable Content
- Synthetic and natural content combined
- High scalability and content-Based Qos
- High level of user Interaction

MPEG-7

- A standard for describing the multimedia content data
- To be used in indexing, searching and browsing of multimedia content



References

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<http://msdn.microsoft.com/library/default.asp?url=/library/en-us/wmform/htm/compressedvideo.asp>