
# MPEG의 과거 및 현재

## MPEG-1/2/4/7/21


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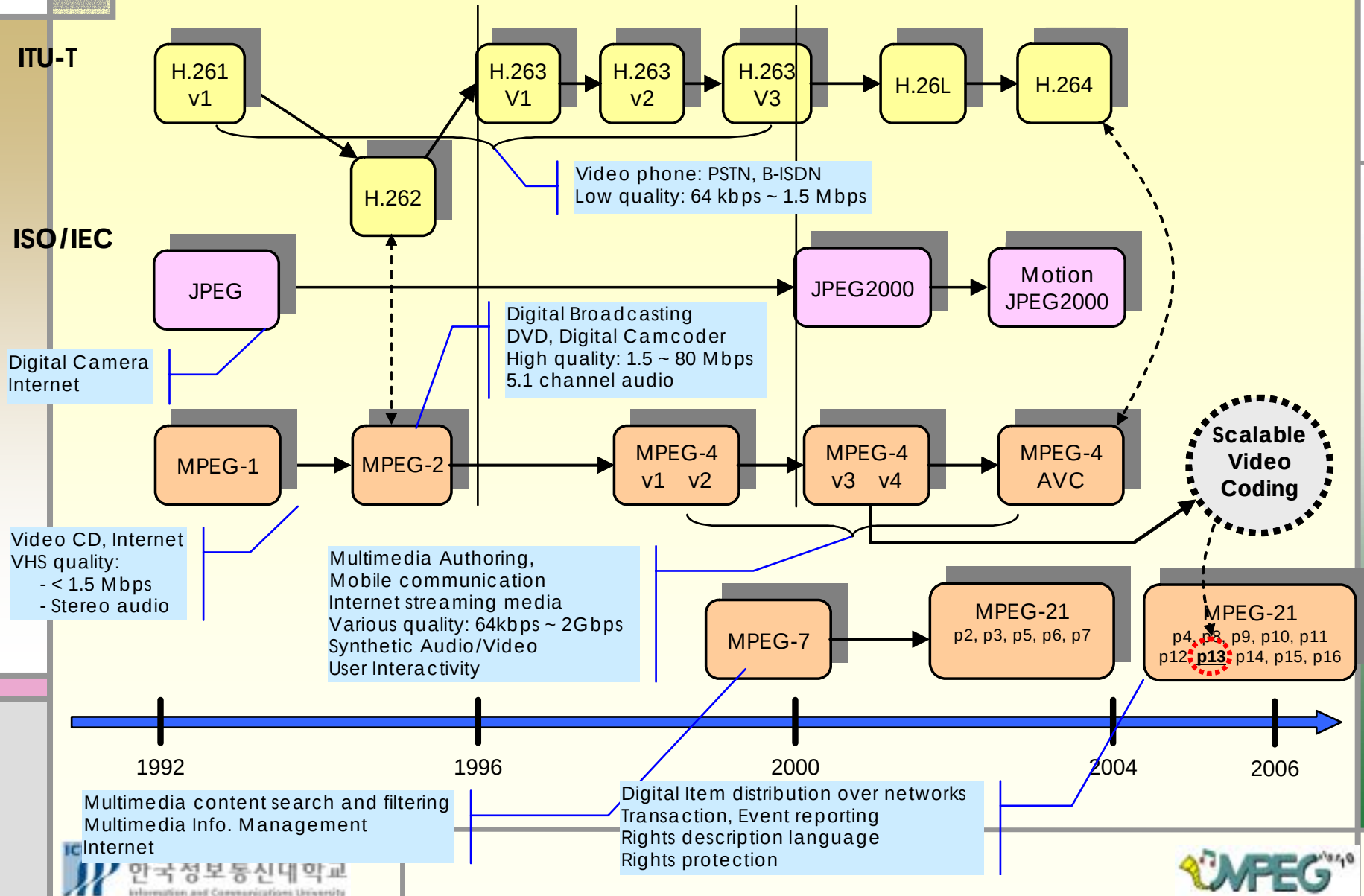
# MPEG Overview



# MPEG-1 Standards

- MPEG-1 Standards
  - ISO/IEC 11172-1 : System
  - ISO/IEC 11172-2 : Video
  - ISO/IEC 11172-3 : Audio
  - ISO/IEC 11172-4 : Conformance
  - ISO/IEC 11172-5 : Software
  - Publications of IS and TR
    - Parts 1, 2 and 3 were issued in Nov. 1992
    - Parts 4 and 5 were issued in Nov. 1994.

- Objectives
  - DSM Applications (e.g. Video CD)
  - Target bitrate: ~1.5 Mbps
    - Well suited for Digital media storage and telecommunication channels

# MPEG-1 Standards

- MPEG-1 Systems
  - ISO/IEC 11172-1
  - Digital Storage Media
  - Packet Multiplexing
    - packetization of elementary streams
    - time division multiplexing of packets
  - Synchronization
    - STC (System Time Clock) : 90kHz
    - SCR (System Clock Reference)
    - DTS (Decoding Time Stamp)
    - PTS (Presentation Time Stamp)

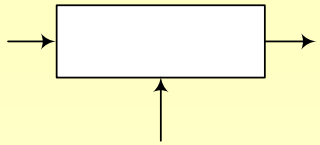
# MPEG-1 Standards

- MPEG-1 Video
  - Extended from H.261
  - VHS picture quality
  - Coding tools
    - DCT for intraframe coding (I-picture)
    - Quantization
    - MC for interframe coding (B- and P-picture)
    - 2D VLC (Zigzag scan)
    - Progressive only (non-interlaced)
- MPEG-1 Audio
  - 16 bits/sample
  - 2 channel coding standard
  - 32, 44.1, 48kHz sampling frequencies
  - Layers
    - Layer I: 32~448 kbps
    - Layer II: 32~384 kbps → Eureka 147
    - Layer III: 32~320 kbps → mp3

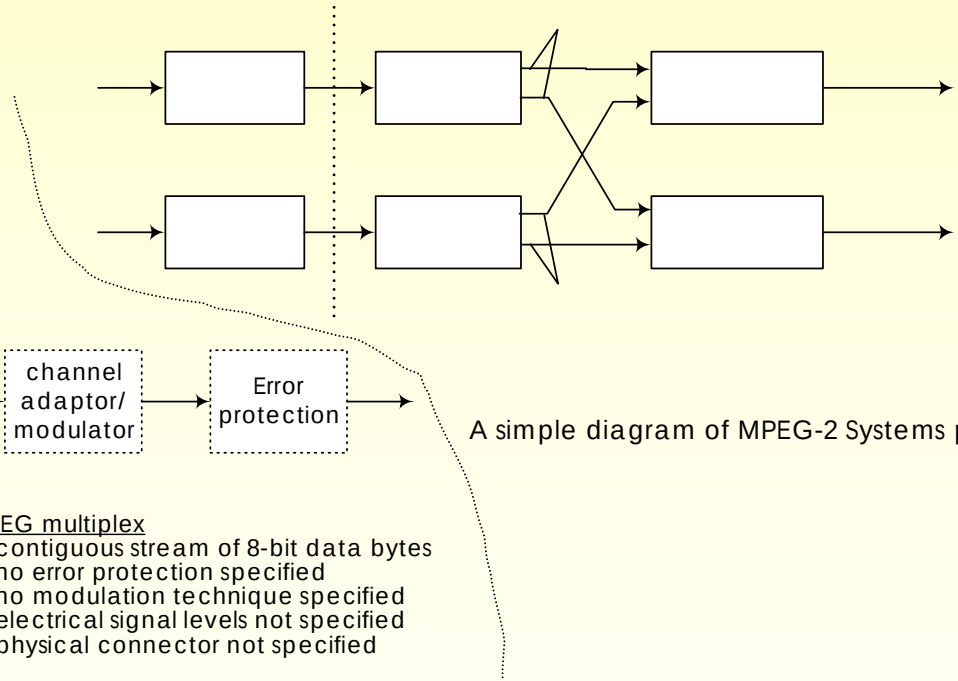
# MPEG-2 Standards

- MPEG-2 Standards
  - ISO/IEC 13818-1 : System
  - ISO/IEC 13818-2 : Video
  - ISO/IEC 13818-3 : Audio
  - ISO/IEC 13818-4 : Conformance testing
  - ISO/IEC 13818-5 : Software simulation
  - ISO/IEC 13818-6 : Extensions for DSM-CC
  - ISO/IEC 13818-7 : Advanced Audio Coding (AAC)
  - ISO/IEC 13818-8 : ISO/IEC 13818-8: 10-Bit Video (dropped!)
  - ISO/IEC 13818-9 : Extension for real time interface for systems decoders
  - ISO/IEC 13818-10 : Conformance extensions for Digital Storage Media Command and Control (DSM-CC)
  - ISO/IEC 13818-11 : IPMP on MPEG-2 systems
- Objectives
  - Generic coding of moving pictures and associated audio
  - Higher bit rates and broader generic applications
    - Telecommunications, HDTV, DVD, VOD, etc.

# MPEG-2 Standards



- MPEG-2 Systems
  - ISO/IEC 13818-1
  - Digital Transmission & Storage
    - ☑ Transport Stream
    - ☑ Program Stream




A simple diagram of MPEG-2 Systems part

An MPEG-2 multiplexer

# MPEG-2 Standards

- MPEG-2 Video
  - Wide range of bit rates
  - Coding tools
    - ☑ MPEG-1 Video Coding Tools +
    - ☑ Scalability
      - SNR, spatial, temporal, simulcast, data partitioning
    - ☑ Progressive/Interlaced (Frame/Field)
    - ☑ 2D VLC (Zigzag and Alternate scans)
    - ☑ Frame-pictures and field-pictures
    - ☑ Input formats: 4:2:0, 4:2:2, 4:4:4
    - ☑ Profiles and levels
      - 5 Profiles of Functionality
        - Simple, Main, Spatial Scalable, SNR Scalable, High
      - 4 Levels of Resolution
        - Low, Main, High-1440, High

# MPEG-2 Standards

- MPEG-2 Audio
  - ISO/IEC 13818-3
    - 16 ~24 bits/sample
    - Backward compatible to ISO/IEC 11172-3
    - Multi-channel coding standard
    - 16, 22.05, 24, 32, 44.1, 48kHz sampling frequencies
    - Layers I, II, III
  - ISO/IEC 13818-7
    - a higher quality multi-channel standard than achievable with MPEG-1 extensions
    - Multi-channel audio
    - 8~96kHz low sampling frequency

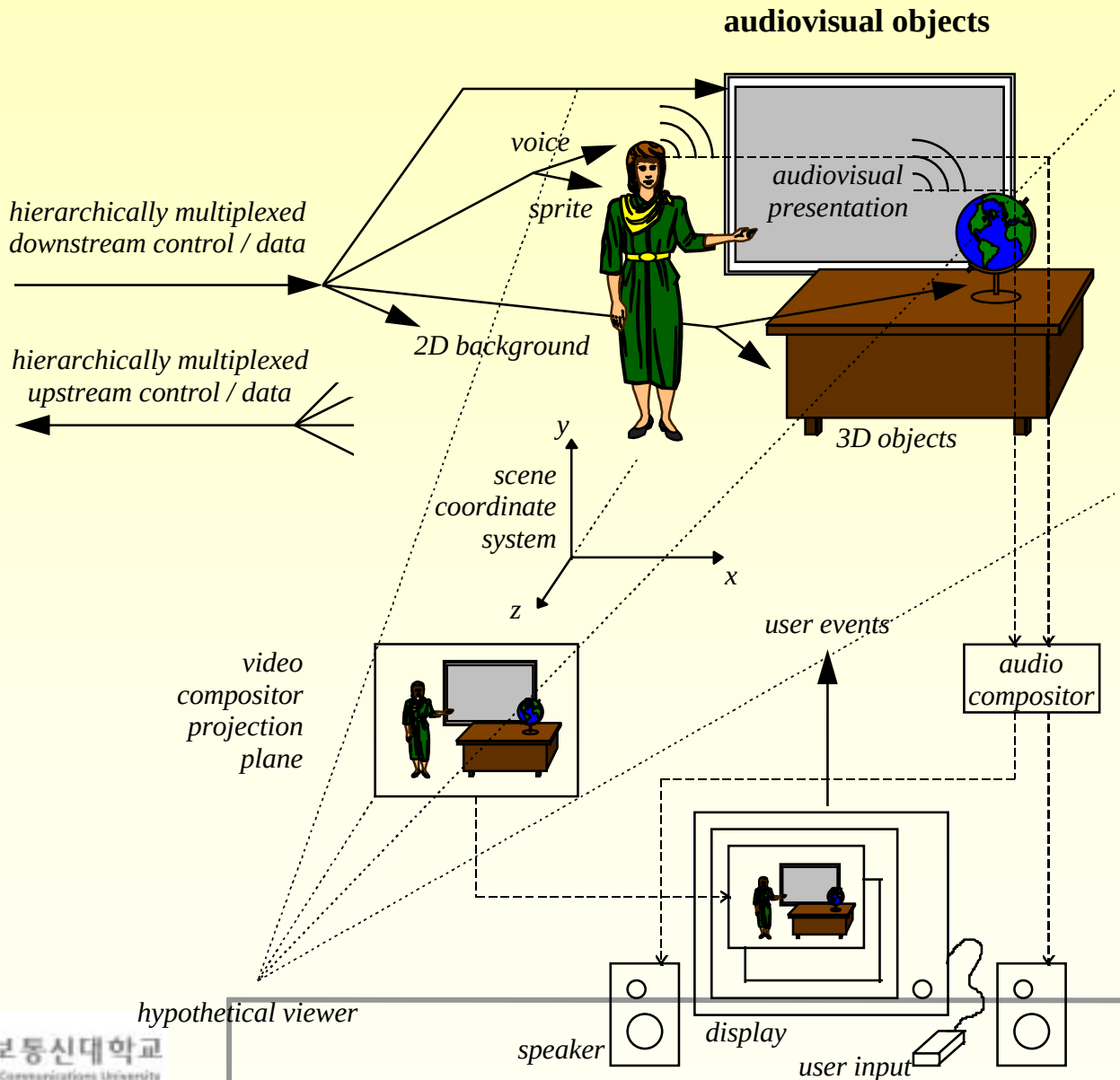
# MPEG-4 Standards

- MPEG-4 Standards
  - ISO/IEC 14496-1 : System
  - ISO/IEC 14496-2 : Visual
  - ISO/IEC 14496-3 : Audio
  - ISO/IEC 14496-4 : Conformance testing
  - ISO/IEC 14496-5 : Reference Software
  - ISO/IEC 14496-6 : Delivery Multimedia Integration Framework (DMIF)
  - ISO/IEC 14496-7 : Optimized reference software for coding of audio-visual objects
  - ISO/IEC 14496-8 : Carriage of ISO/IEC 14496 contents over IP networks
  - ISO/IEC 14496-9 : Reference hardware description
  - ISO/IEC 14496-10 : Advanced Video Coding
  - ISO/IEC 14496-11 : Scene description and application engine
  - ISO/IEC 14496-12 : ISO base media file format
  - ISO/IEC 14496-13 : IPMP extensions
  - ISO/IEC 14496-14 : MP4 file format
  - ISO/IEC 14496-15 : Advanced Video Coding (AVC) file format
  - ISO/IEC 14496-16 : Animation Framework eXtension (AFX)
  - ISO/IEC 14496-17 : Streaming text format
  - ISO/IEC 14496-18 : Font compression and streaming
  - ISO/IEC 14496-19 : Synthesised texture stream
  - ISO/IEC 14496-20 : Lightweight Application Scene Representation (LASeR) and Simple Aggregation Format (SAF)
  - ISO/IEC 14496-21 : MPEG-J extensions for rendering

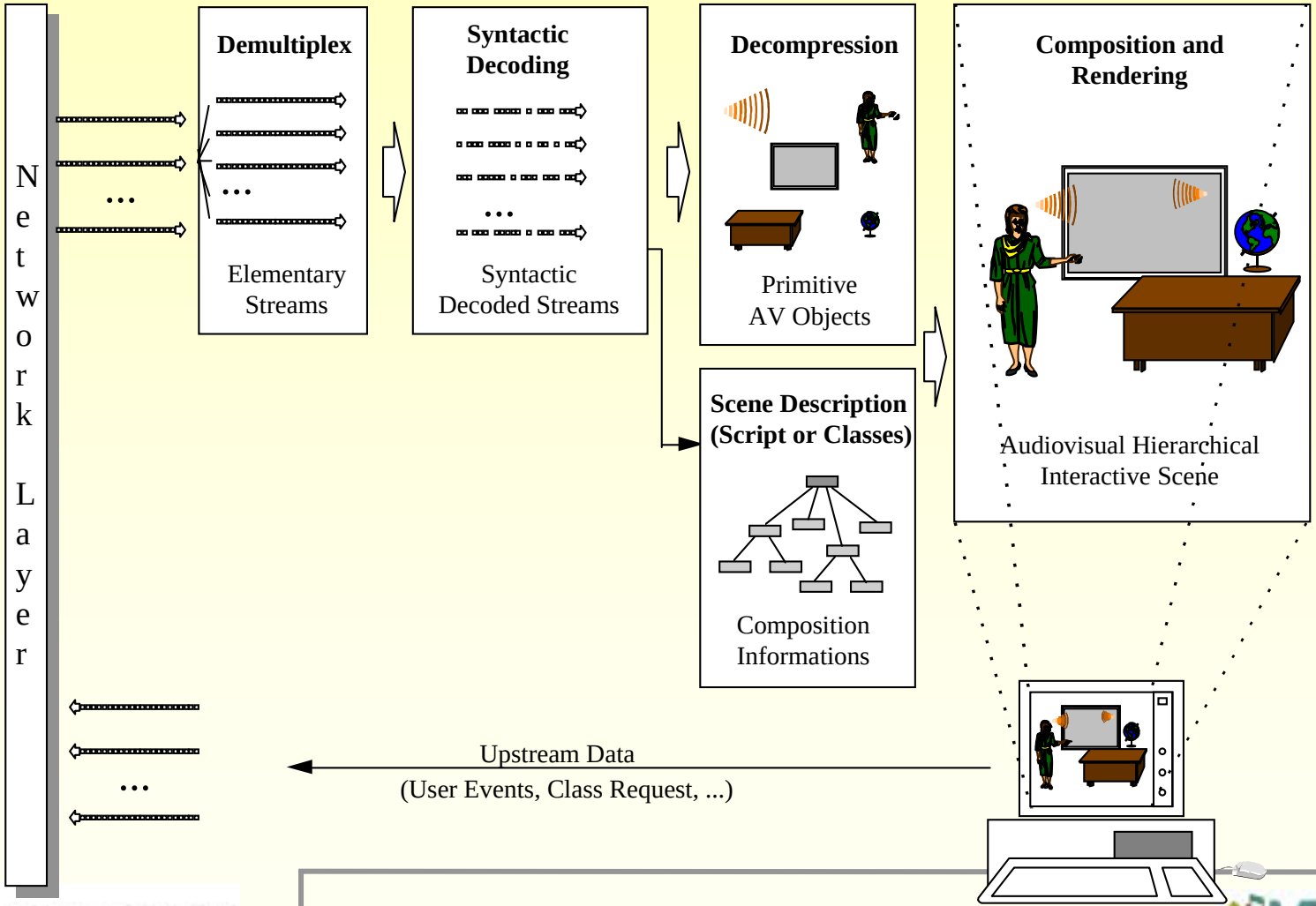
# MPEG-4 Standards

- MPEG-4 Objectives
  - Content based Interactivity
    - Content-based Multimedia Data Access Tools
    - Content-based Manipulation and Bit-stream Editing
    - Hybrid Natural and Synthetic AV Object Coding
    - Improved Random Access
  - Compression
    - Improved Coding Efficiency
    - Coding of Multiple Concurrent Data Streams
  - Universal Access
    - Robustness in Error-prone Environments
    - Content-Based Scalability

# MPEG-4 Standards



# MPEG-4 Standards

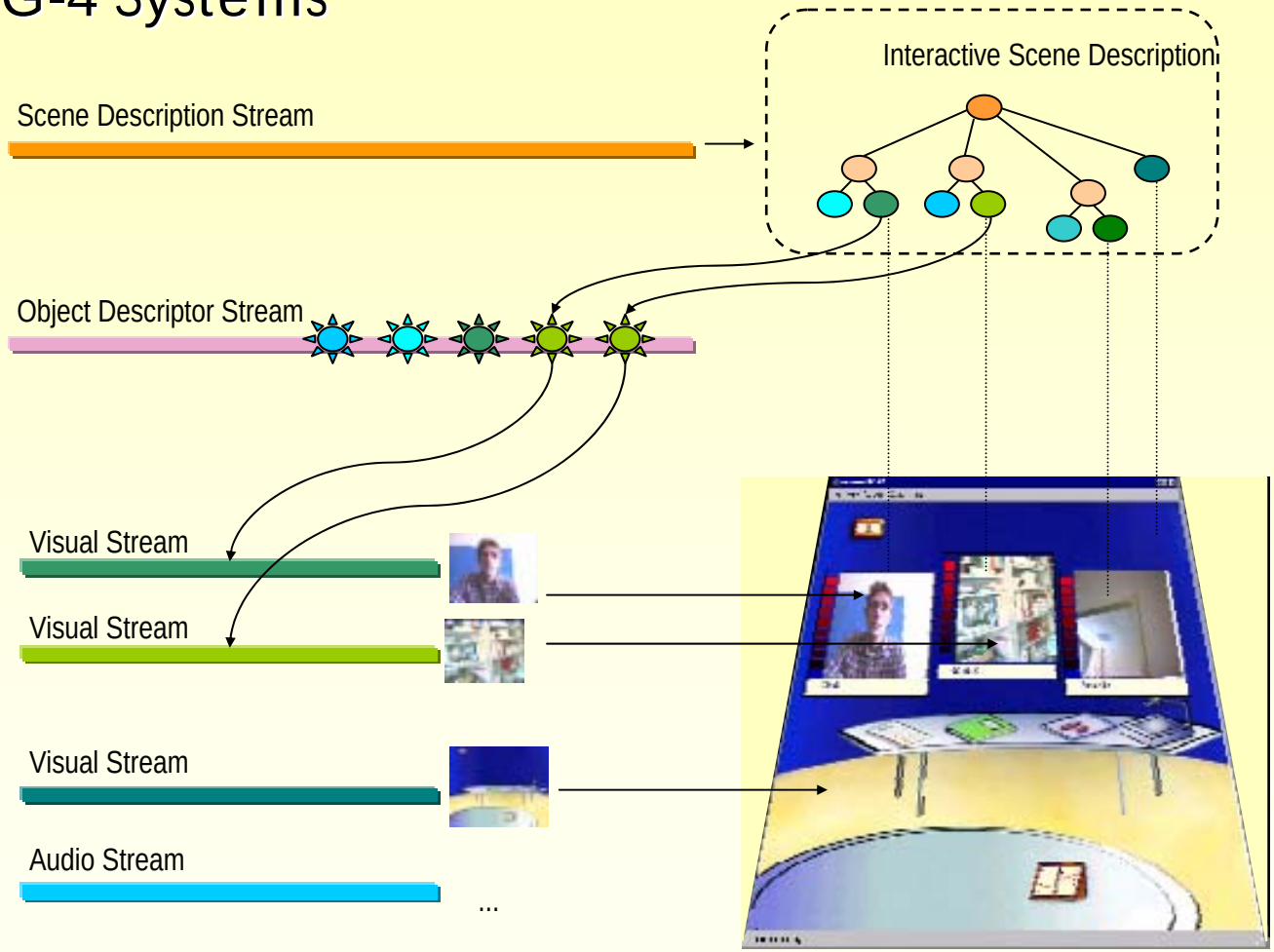


# MPEG-4 Standards

- MPEG-4 Systems
  - Scene description (BIFS: Binary Format for Scene)
  - Object Description Framework
  - Synchronization
  - File Format
  - MPEG-J
  - IPMP/IPMPX

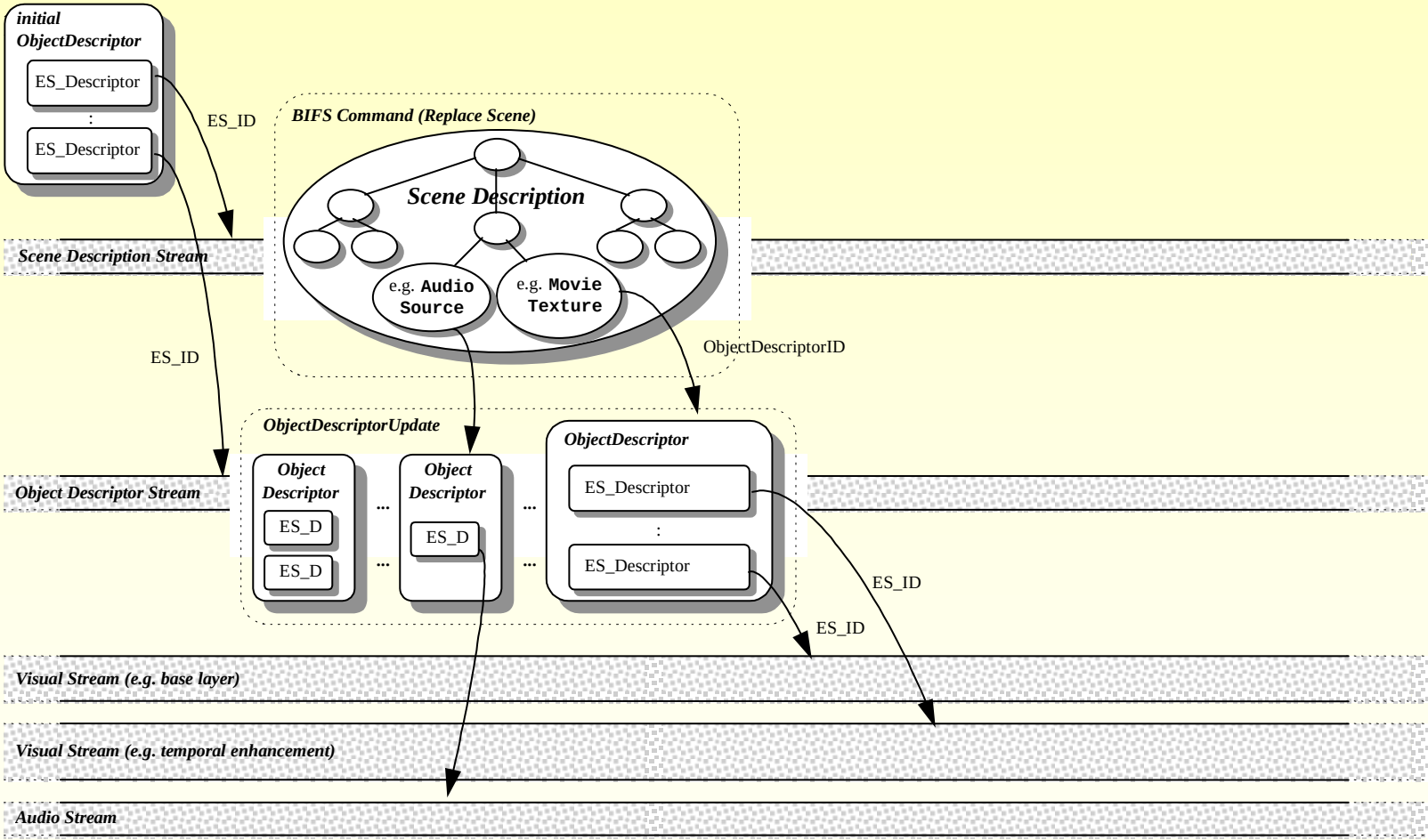
# MPEG-4 Standards

## MPEG-4 Systems



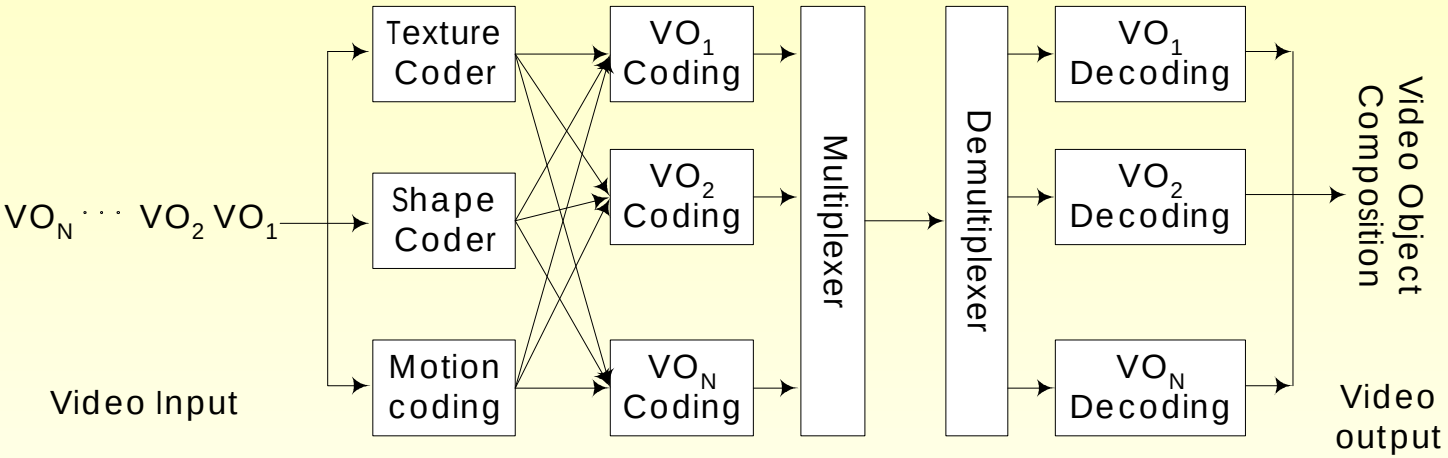
# MPEG-4 Standards

## MPEG-4 Systems



# MPEG-4 Standards

- MPEG-4 Visual
  - Codec

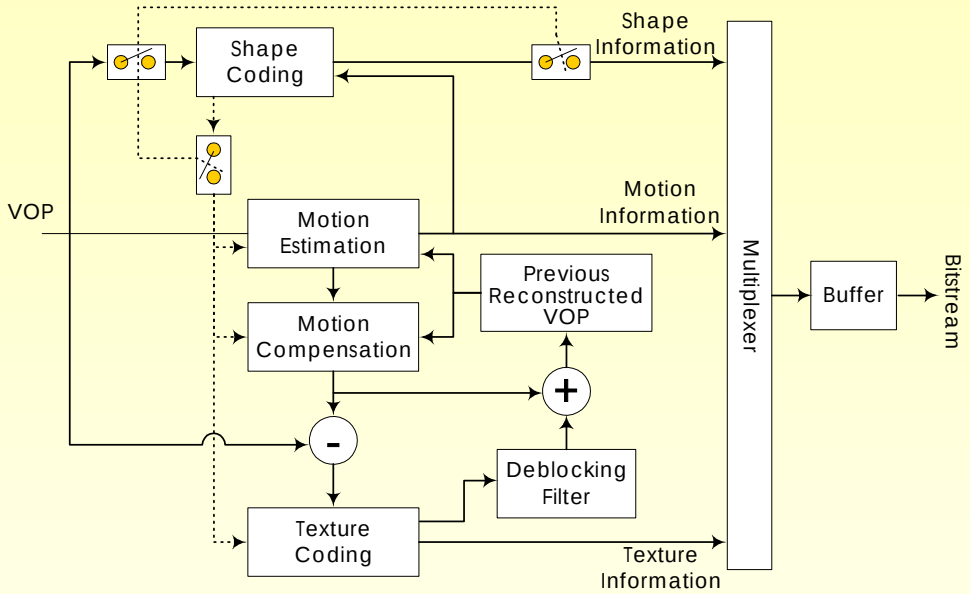



  - Coding tools
    - ☑ Shape Coding
      - Binary Shape Coding, Gray-scale Shape Coding
    - ☑ Motion Coding
    - ☑ Texture Coding

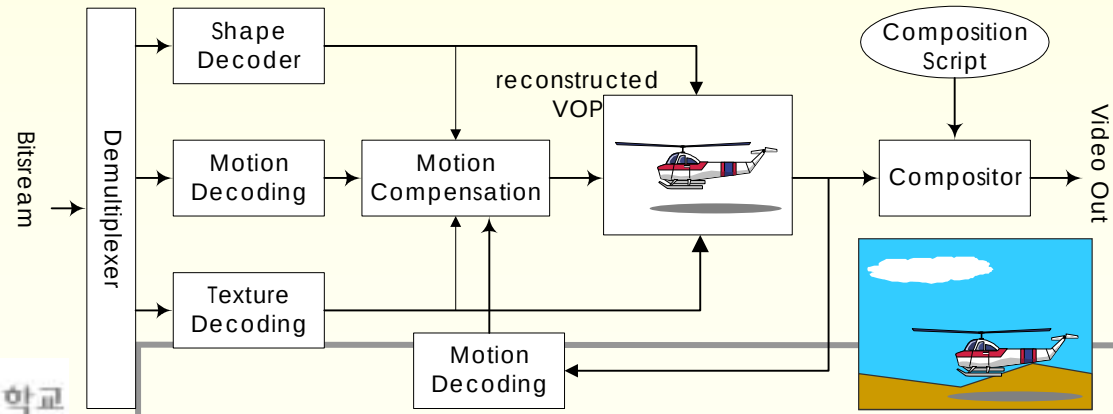
# MPEG-4 Standards

## MPEG-4 Visual

MPEG-4 Video Encoder




MPEG-4 Video Decoder



# MPEG-4 Standards

- MPEG-4 Audio
  - MPEG-4 Speech Coding
  - MPEG-4 General Audio Coding
  - MPEG-4 Audio Synthesis
  - MPEG-4 Audio Composition

# MPEG-7 Standards

- MPEG-7 Standards
  - ISO/IEC 15938-1 : System
  - ISO/IEC 15938-2 : Description definition language
  - ISO/IEC 15938-3 : Visual
  - ISO/IEC 15938-4 : Audio
  - ISO/IEC 15938-5 : Multimedia description schemes
  - ISO/IEC 15938-6 : Reference software
  - ISO/IEC 15938-7 : Conformance testing
  - ISO/IEC 15938-8 : Extraction and use of MPEG-7 descriptions
  - ISO/IEC 15938-9 : Profiles and levels
  - ISO/IEC 15938-10 : Schema definition

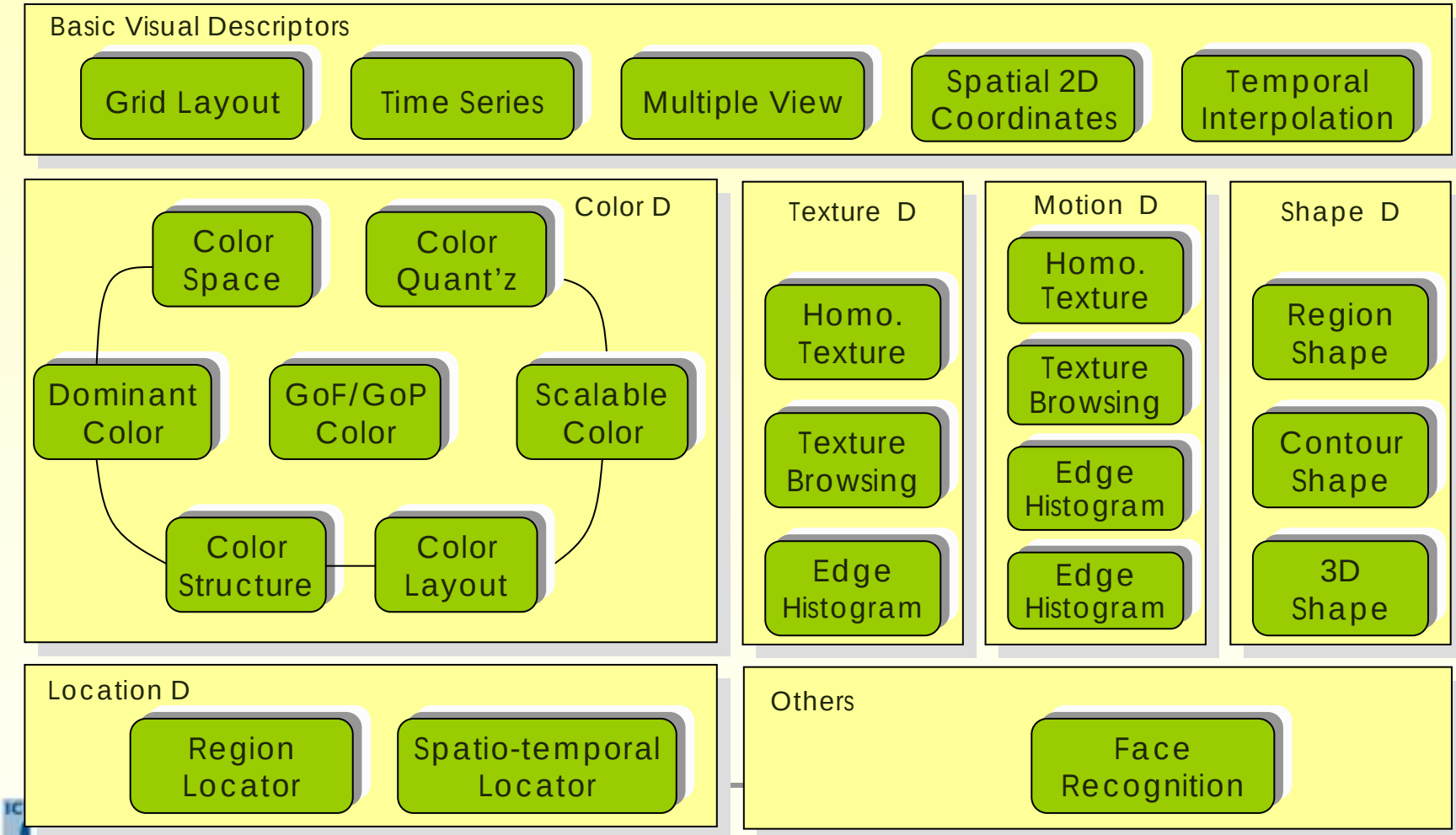
- What is MPEG-7?
  - Representation of information about the content
    - “Metadata”
    - “Bits about Bits”

# MPEG-7 Standards

- Systems
  - BiM (Binary format for Metadata)
  - TeM (Textualformat for Metadata)
- Audio Descriptors
  - Description Categories
    - ☑ non-perceptual low-level signal information
    - ☑ Perceptual low-level information
    - ☑ Perceptual high-level information
    - ☑ Information not derived from audio signal
  - Describe low level features
    - ☑ Spectrum, mood, rhythm, spoken content etc.
  - Applications
    - ☑ Searching/Filtering speech and sound effect collections

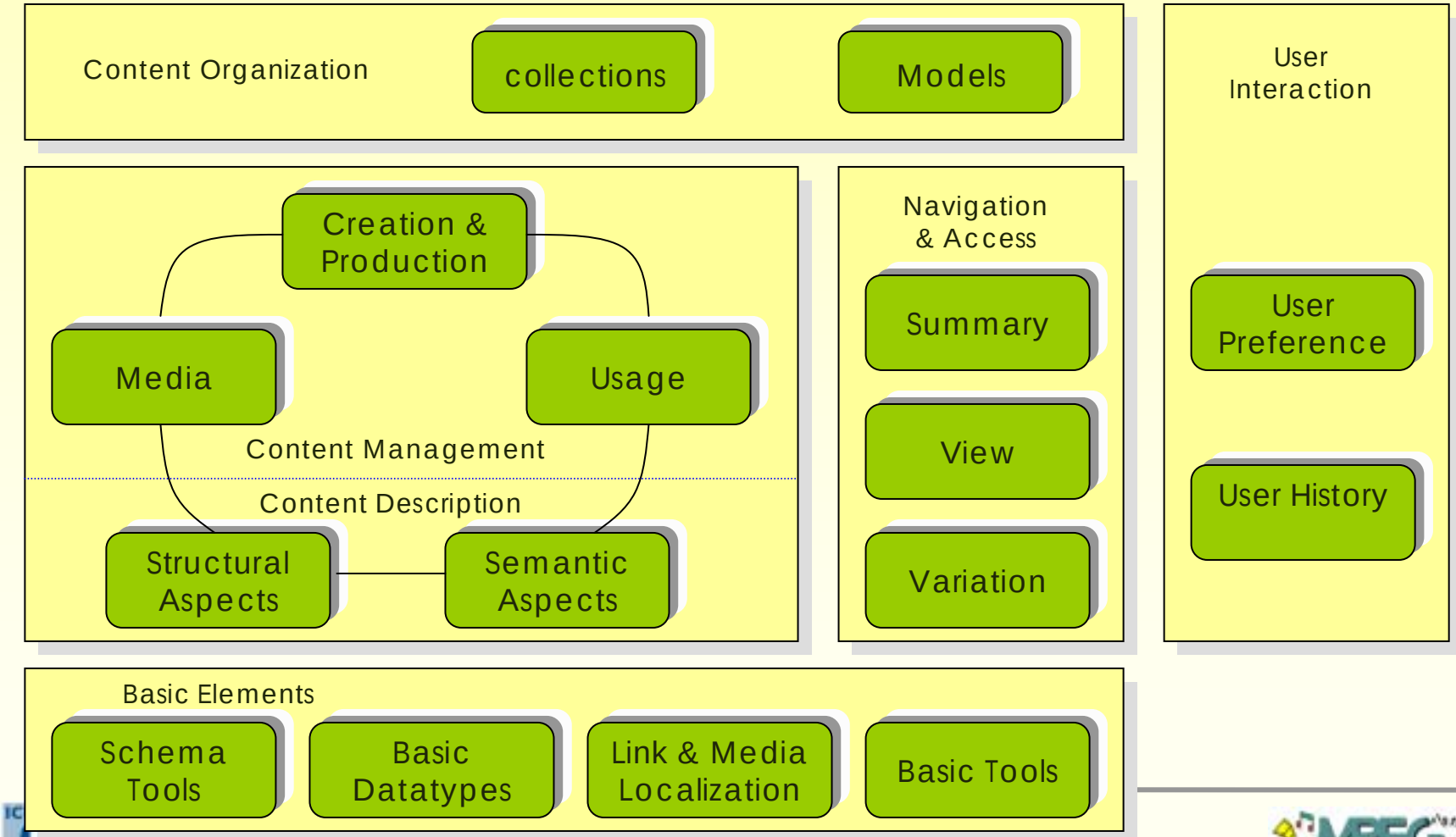
# MPEG-7 Standards

## Overview of Visual Descriptors



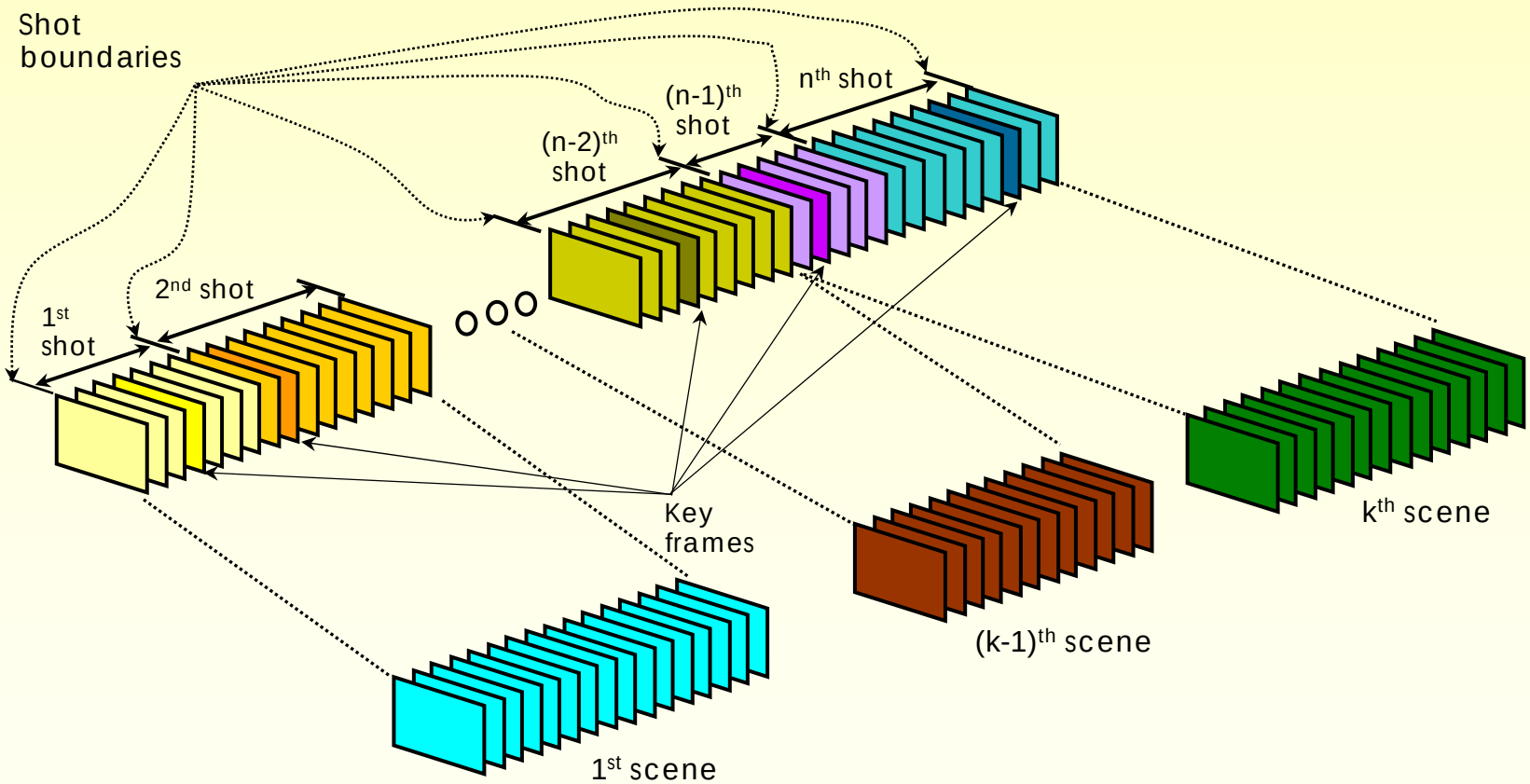
# MPEG-7 Standards

## Overview of Multimedia Description Schemes



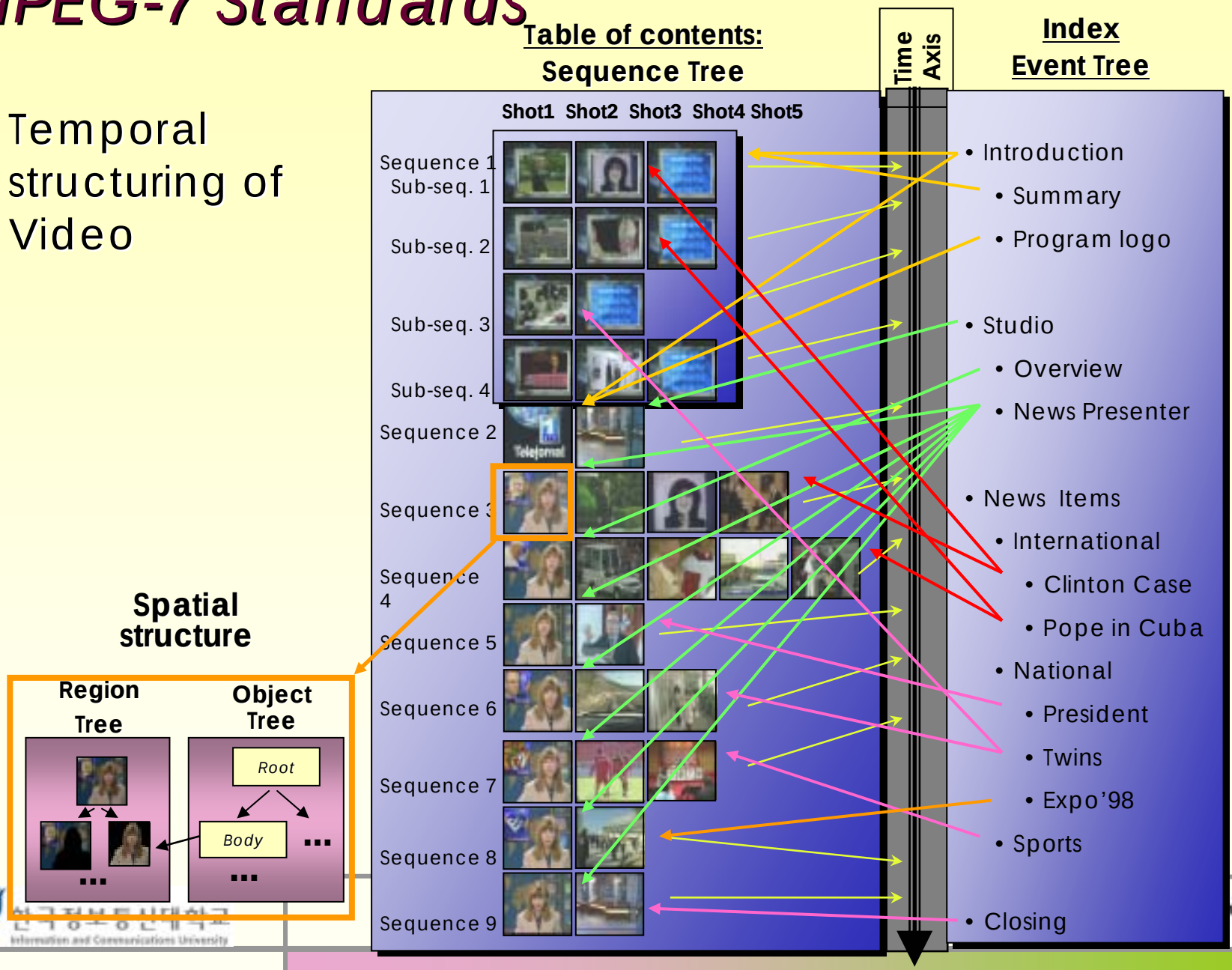
# MPEG-7 Standards

## Temporal structuring of Video



# MPEG-7 Standards

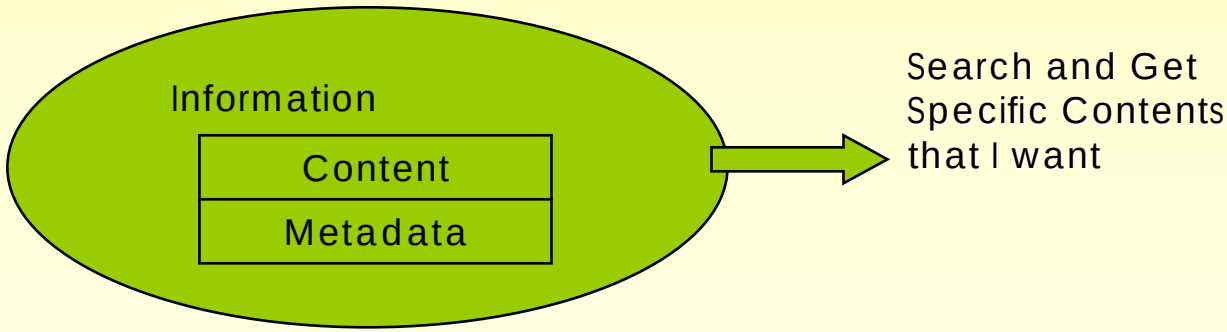
- Temporal structuring of Video



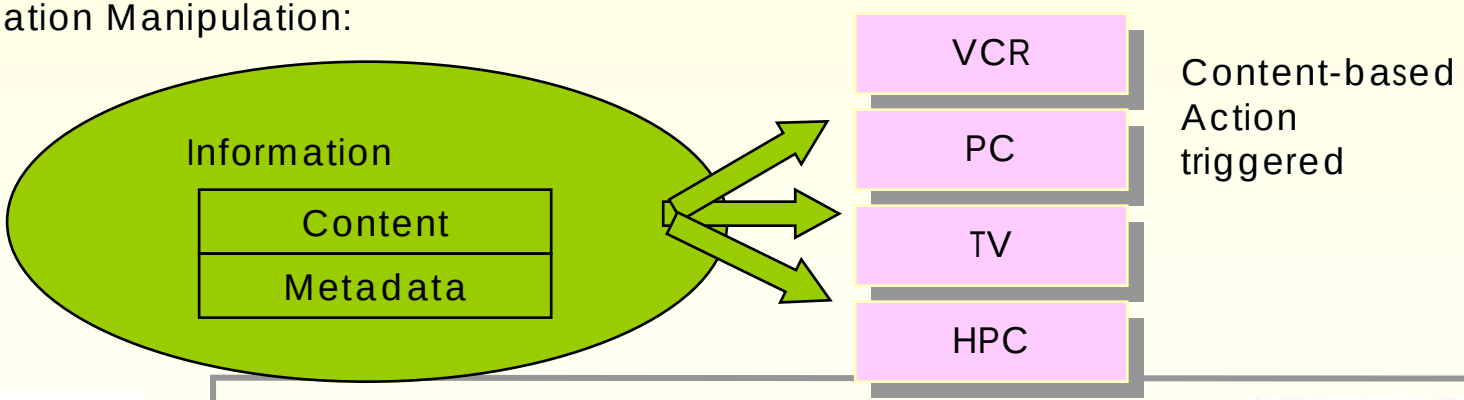
# MPEG-7 Standards

## MPEG-7 Applications

Information Search:



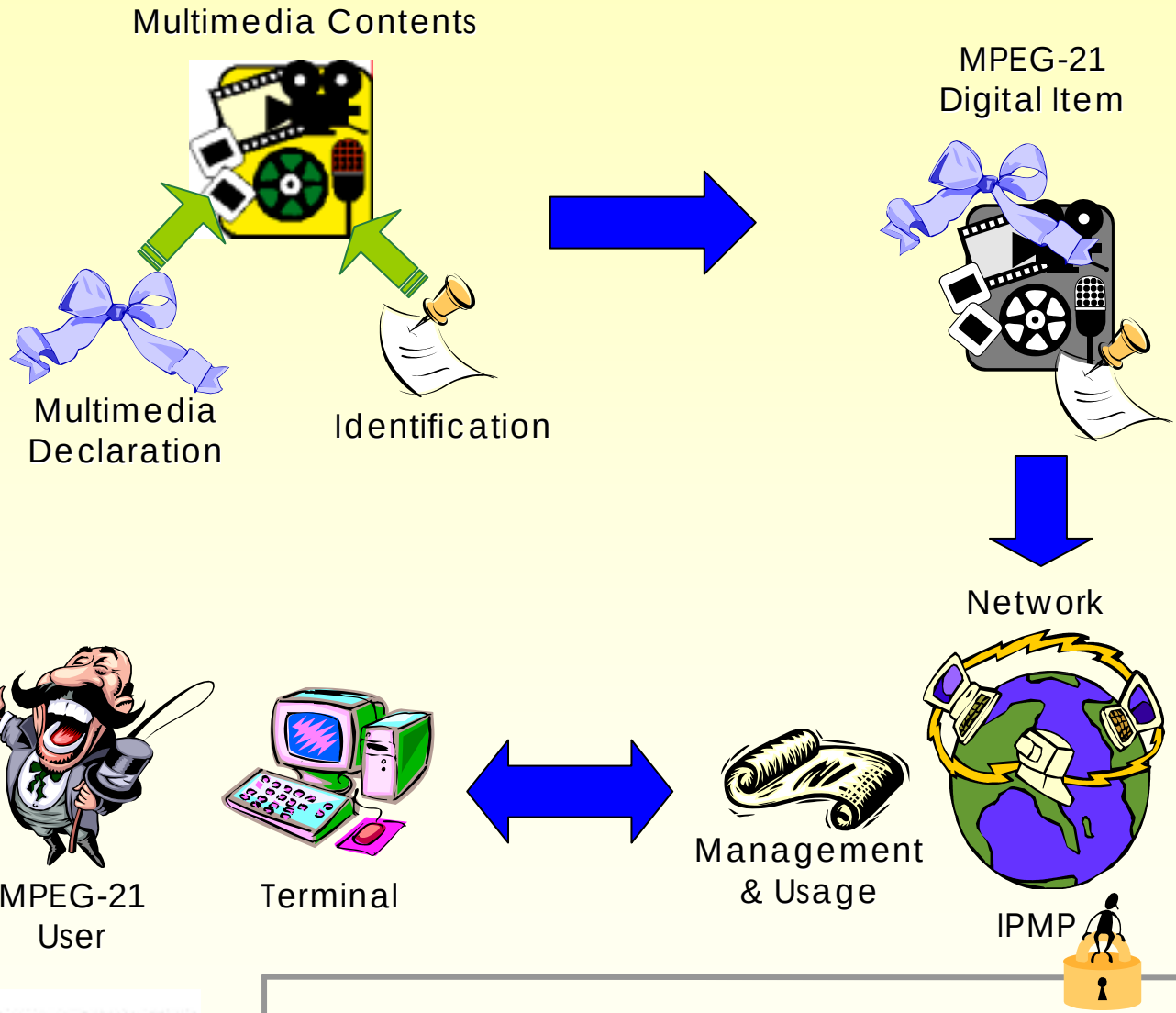

Information Manipulation:



# MPEG-21 Standards

- MPEG-21 Standards
  - 21000-1: Vision, technologies and strategies
  - 21000-2: Digital Item Declaration
  - 21000-3: Digital Item Identification
  - 21000-4: Intellectual Property Management and Protection
  - 21000-5: Rights Expression Language
  - 21000-6: Rights Data Dictionary
  - 21000-7: Digital Item Adaptation
  - 21000-8: Reference Software
  - 21000-9: File Format
  - 21000-10: Digital Item Processing
  - 21000-11: Persistent Association
  - 21000-12: Testbed for MPEG-21 Resource Delivery
  - 21000-13: Scalable Video Coding
  - 21000-14: Conformance
  - 21000-15: Event Reporting
  - 21000-16: MPEG-21 Binarization

# Multimedia Environments



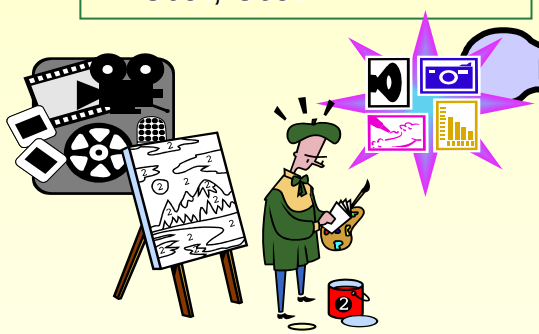
# Multimedia Environments

Contents & Rights holder

We want....
- No piracy
- No illegal distribution
- Safe collection of $$
- etc., etc.

Consumers

We want....
- Privacy
- Simple terminal
- Easy to find, pay, share
- etc., etc.



payment
(re)use
manipulation
IP protection
adaptation
privacy
search
storage
access
property
delivery
networks
IP management
identification
distribution
representation
creation

How can I create standard content?

My content can be protected from illegal usage?

Integrated Framework is necessary!

Is it possible to easily use contents?

My privacy is protected?

**MPEG-21 Multimedia Framework**

# MPEG-21 Standards

- Digital Item
  - A Digital Item is a structured digital object with a standard representation, identification and metadata within the MPEG-21 framework.
  - This entity is also the fundamental unit of distribution and transaction within this framework.

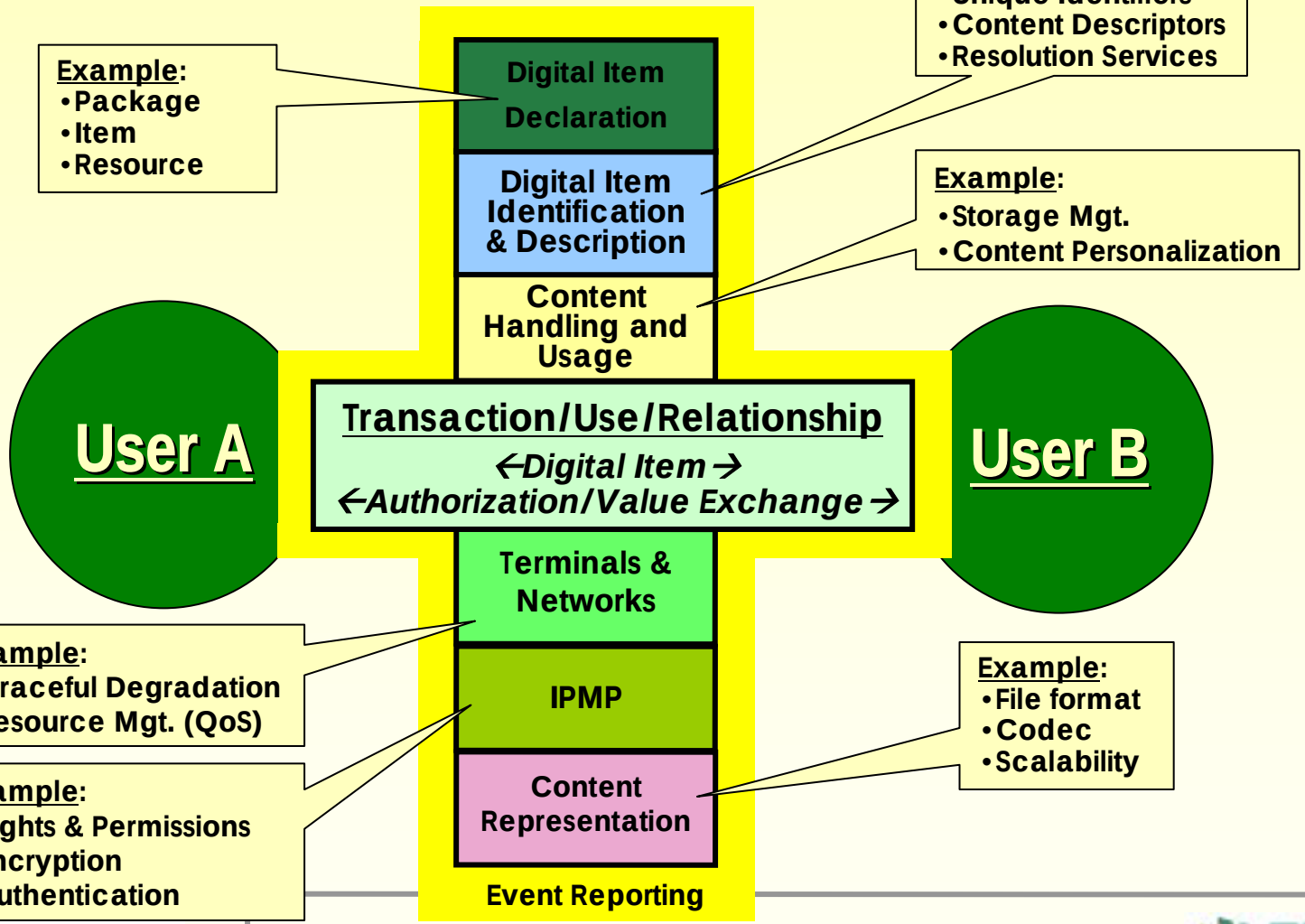
# Part 2 - Digital Item Declaration

- DID Abstract Model

## Digital Item

# MPEG-21 Standards

- 7 elements in MPEG-21



# MPEG-21 Standards

- MPEG-21 Standard Parts

# MPEG-21 Standards

## Digital Item Declaration

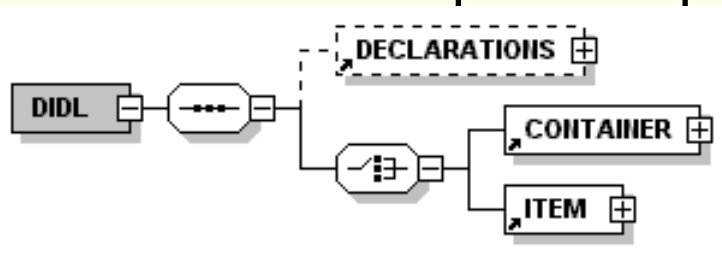
### DIDL Definition

The DIDL element is the root element of a DIDL instance document.

The DIDL root element may contain an optional Declarations element, followed by exactly one Container or Item.

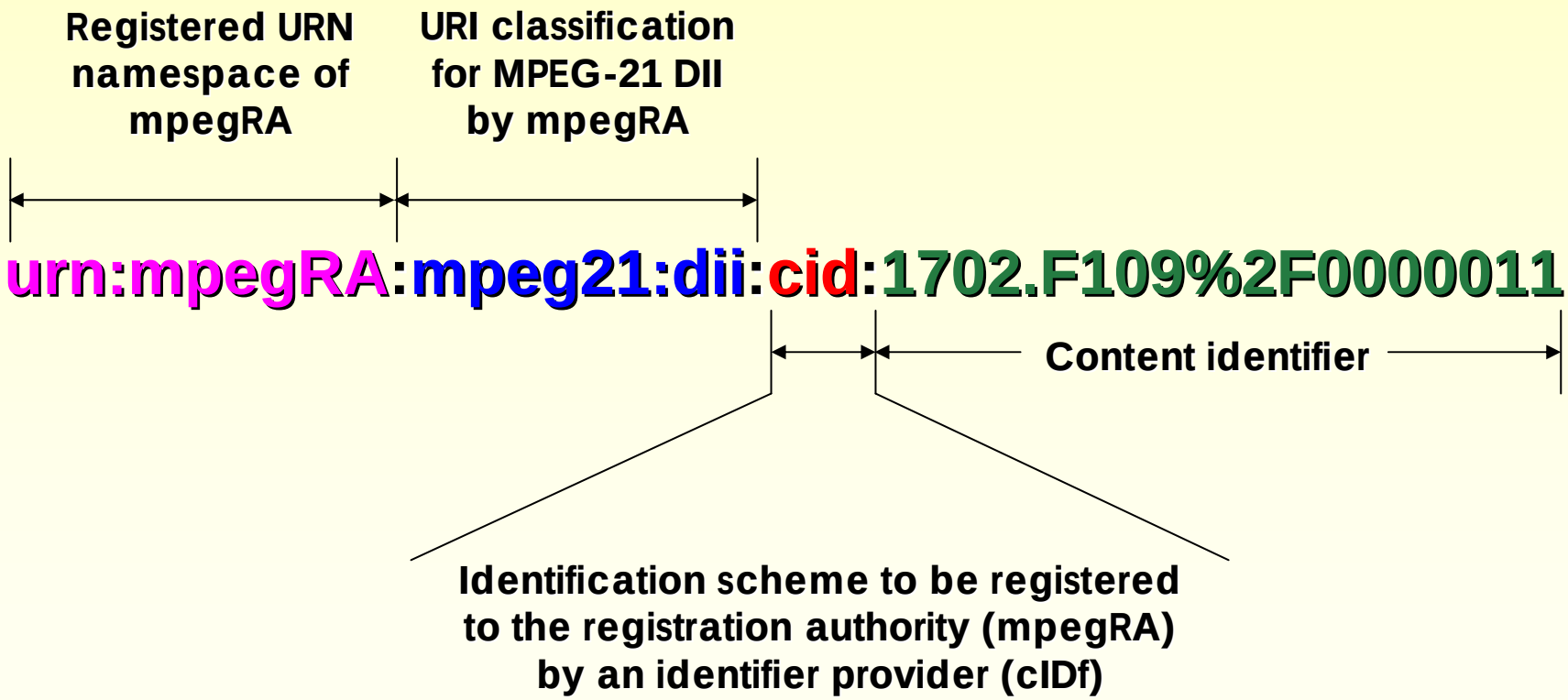
```
<DIDL xmlns="urn:mpeg:mpeg21:2002:01-DIDL-NS">
...
</DIDL>
```

| Children | <Declarations> <Container> <Item> |
|---|---|
| Source | <xsd:element name="DIDL"><br><xsd:complexType><br><xsd:sequence><br><xsd:element ref="Declarations" minOccurs="0"/><br><xsd:choice><br><xsd:element ref="Container"/><br><xsd:element ref="Item"/><br></xsd:choice><br></xsd:sequence><br></xsd:complexType><br></xsd:element> |

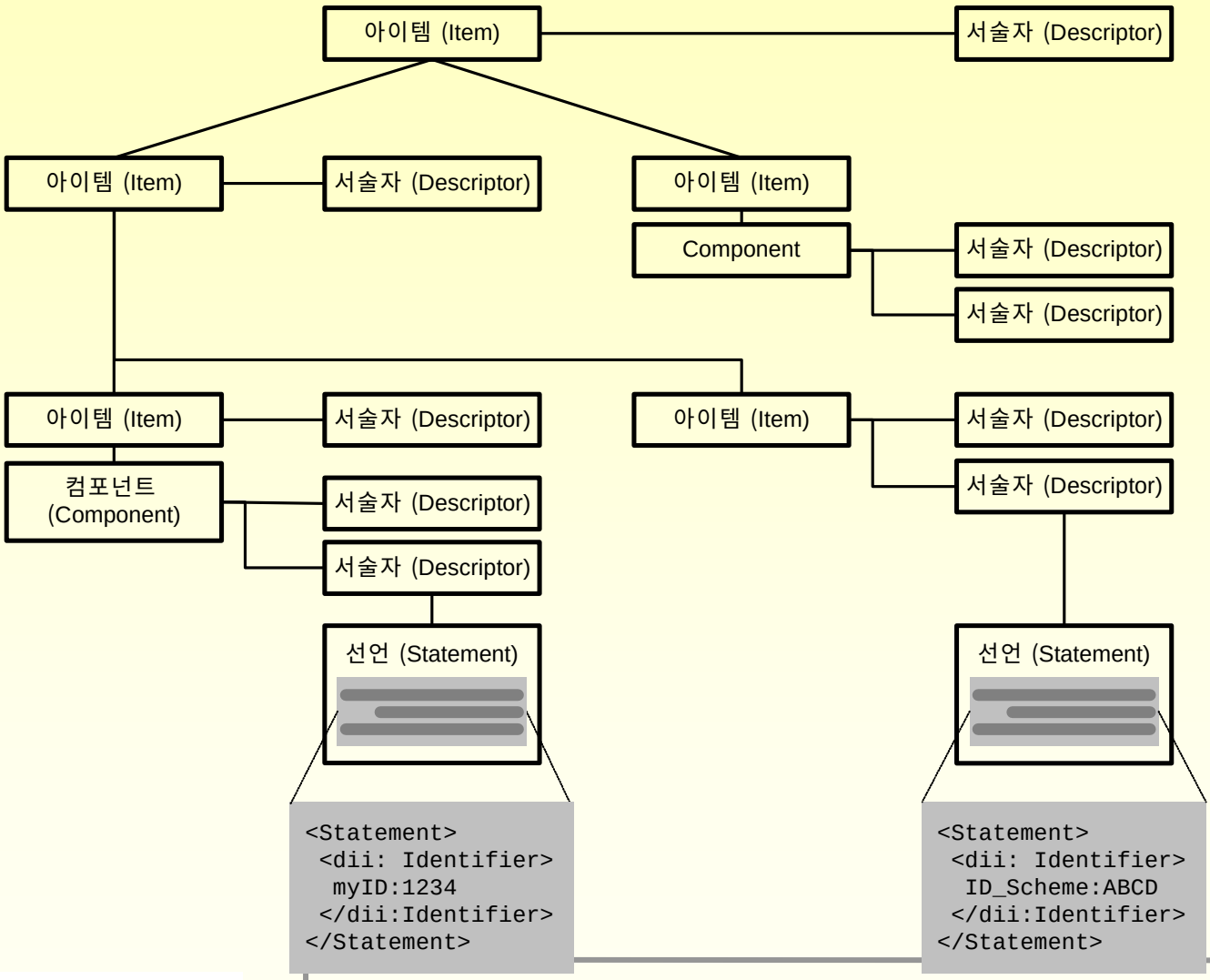


# MPEG-21 Standards

- Digital Item Identification
  - Identification Systems
    - Structure of an Digital Item Identifier



# MPEG-21 Standards



# MPEG-21 Standards

- Digital Media
  - Separation of representation and delivery
  - One source for multi-purpose: multi-devices,

- *MPEG-21 provides, "a big picture", a multimedia framework for integrating the essentials tools for the representation, delivery and exchange of contexts/contents.*

- *MPEG-21 moves towards Ubiquitous Multimedia in Secured Environments!*

# Comments

- MPEG
  - Has been around 16 years by giving birth to
    - MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21
  - Produced Generic coding tools, but
  - Are doing not only generic coding for multimedia but also generic information representation for multimedia and environment
- Glory of MPEG
  - Some parts of MPEG have been very successful!
    - DTV/DVD(MPEG-2), Mp3(MPEG-1 Audio Layer III), DMB(MPEG-4 Part 10)
- Threats to MPEG
  - Many standard parts are far away from the markets.
  - No longer the only solutions for application domains
  - Competition with defacto standards
  - Approaches to generic coding and representation are competitive?