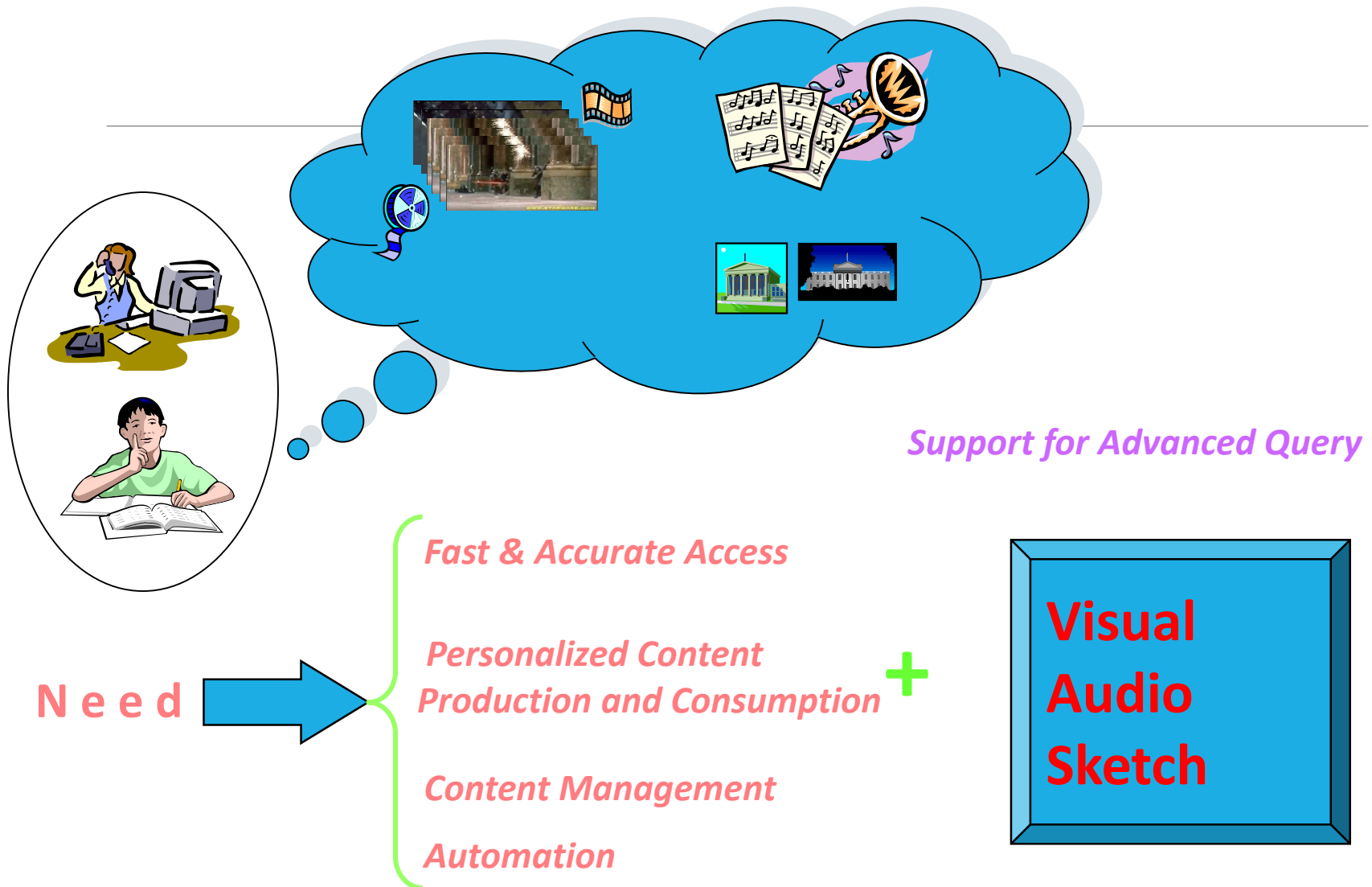


MPEG-7

Outline

- Objectives of the MPEG-7 Standard
- Main Elements of MPEG-7
- Scope of MPEG-7
- MPEG-7 Application Areas
- MPEG 7's relation with other standards

Why do we need MPEG-7 ?



MPEG: A Brief History

- MPEG: Moving Picture Experts Group

Established in 1988

- ISO / IEC/JTC1/SC29/WG11

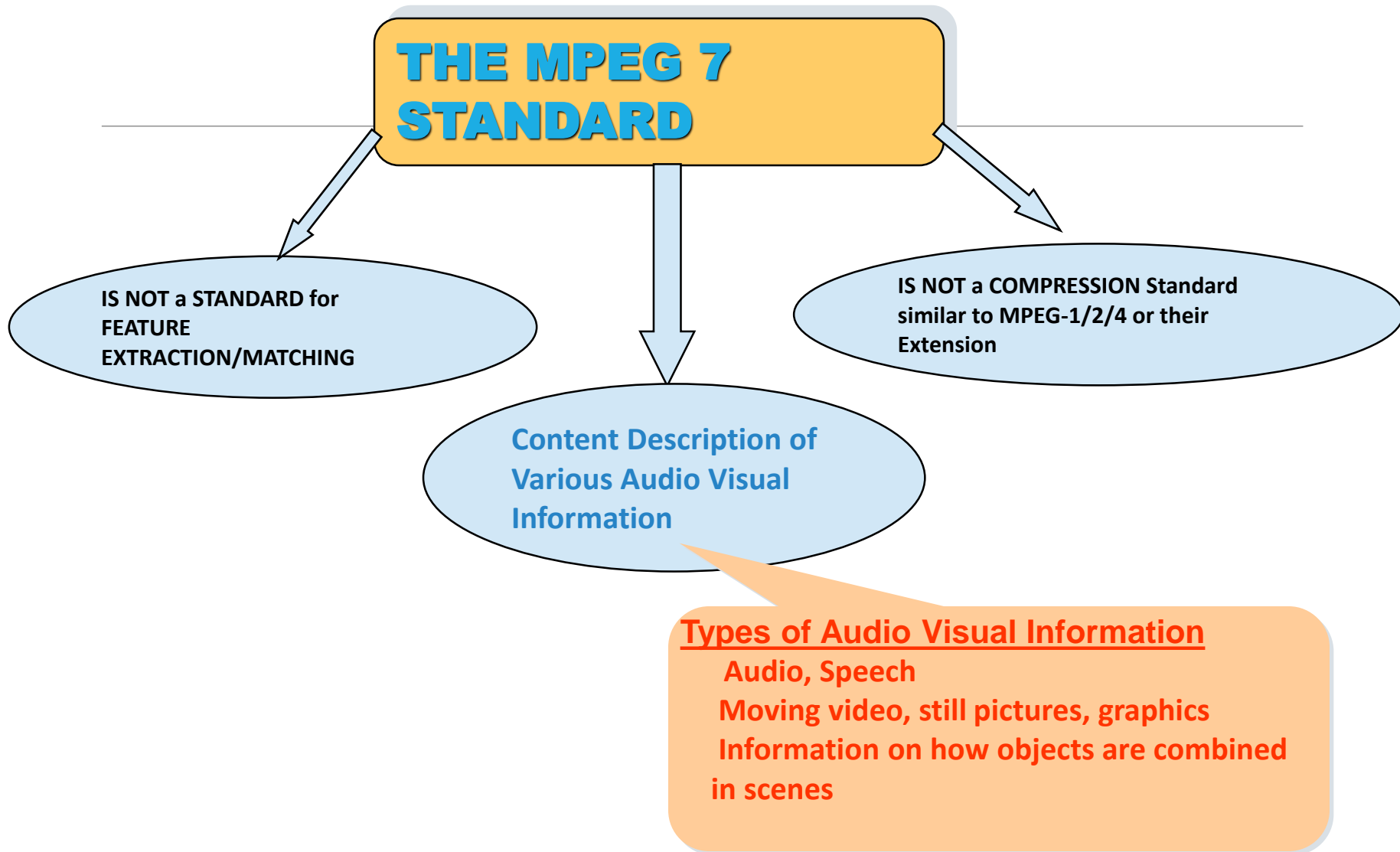
A Working Group of ISO/IEC in charge of the
Development of Standards for
Coded Representation of Digital Audio and Video

MPEG-7: What Is It ?

- Multimedia Content Description Interface
- It includes **standardized tools** enabling structural, detailed descriptions of audio-visual information at different **granularity levels** and in **different areas**.
 - Standardized tools: descriptors, description schemes, and language
 - Granularity levels: region, image, video segment, collection
 - Different areas: content description, management, organization, navigation, and user interaction

MPEG-7 focus on describing multimedia content while MPEG1, 2 and 4 focus on coding and representing of audio-visual content

MPEG-7: What Is It ?



MPEG-7: achievable tasks

The MPEG-7 descriptions allow users or applications to perform the following tasks:

- *Multimedia* - Generate a customised program guide or summary
- *Archive* - Seamlessly exchange content and descriptions
- *Adaptation* – Filter and transform the multimedia to match the user preference, available resources.
- *Music/Audio* - Play a few notes on a keyboard and get in return a list of musical pieces containing (or close to) the tune

MPEG-7: achievable tasks

- *Graphics* - Draw a few lines on a screen and get in return a set of images containing similar graphics, logos, or ideograms.
- *Movement* - With a given set of video objects, describe movements and relations between objects and get in return a list of animations or video clips fulfilling the described temporal and spatial relations.
- *Scenario* - On a given audiovisual content, describe actions and get in return a list of scenarios (i.e., audio-visual segments) where similar actions take place

MPEG-7: Application Areas

- Storage and retrieval of audiovisual databases (*image, film, radio archives*)
- Broadcast media selection (*radio, TV programs*)
- Surveillance (*traffic control, surface transportation, production chains*)
- E-commerce and Tele-shopping (*searching for clothes / patterns*)
- Remote sensing (*cartography, ecology, natural resources management*)
- Entertainment (*searching for a game, for a karaoke*)
- Cultural services (*museums, art galleries*)
- Journalism (*searching for events, persons*)
- Personalized news service on Internet (*push media filtering*)
- Intelligent multimedia presentations
- Educational applications
- Bio-medical applications

MPEG-7 Description Scope for AV Content

- ☐ Description Granularity

 - ☐ Low-level

 - ☐ High-level

- ☐ Form

- ☐ Access

- ☐ Classification

- ☐ Link

- ☐ Context

MPEG-7: Important terms

Feature

- A characteristic of the data

Descriptors (D)

- A definition (syntax and semantics) of each feature

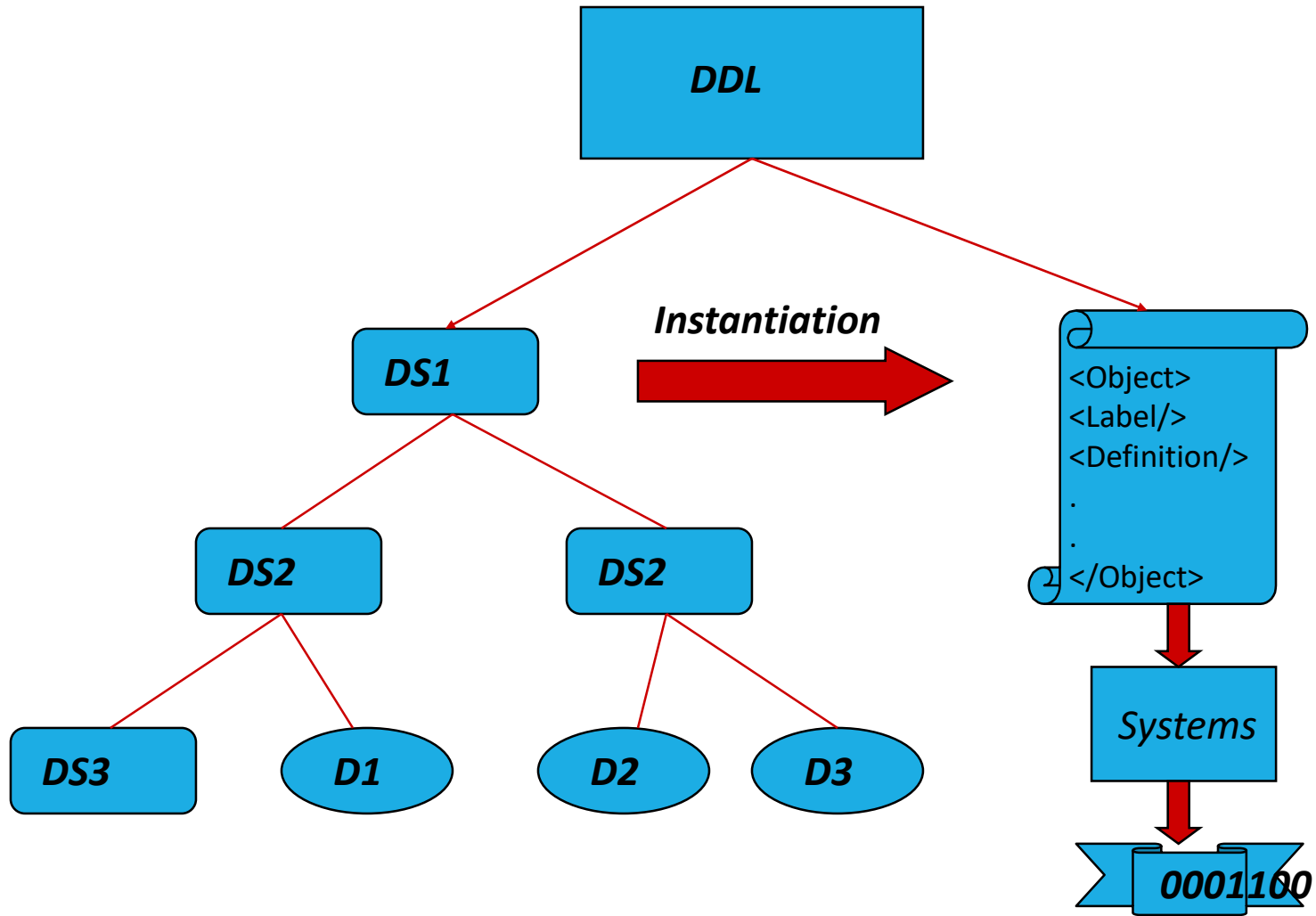
Description Schemes (DS)

- Specification of the structure and semantics of the relationships among Ds and DSs

Description Definition Language (DDL)

- Allows flexible definition of DSs and Ds based on XML schema
- modification/extension of existing DSs

MPEG-7: Main Elements



MPEG-7: Major Functionalities

- ISO/IEC 15938-1 Systems
- ISO/IEC 15938-2 Description Definition Language
- ISO / IEC 15938-3 Visual
- ISO / IEC 15938-4 Audio
- ISO/IEC 15938-5 Multimedia Description Scheme
- ISO/IEC 15938-6 Reference Software
- ISO/IEC 15938-7 MPEG-7 Conformance

Part 1: Systems

It defines system level functionalities to:

- *provide for efficient storage and transport*
- *synchronize between content and description*
- *manage and protect intellectual property*

Part 2: DDL

Description Definition Language:

- A standardized language for defining the Ds and DS's
- Derived by extensions of XML Schema.

XML Schema:

- Data types
- Simple and Complex types
- Elements, attributes
- Inheritance, Abstract types

MPEG-7 extensions:

- Array and Matrix data type

Part 3: Visual

Specifies a set of standardized visual descriptors and description schemes.

- Color

Color space, color quantization, dominant colors, scalable color, color-structure, color layout, GoF/GoP

- Texture

Homogeneous Texture, Texture browsing and edge histogram

- Shape

region-based shape, contour-based shape, 3D shape

- Motion

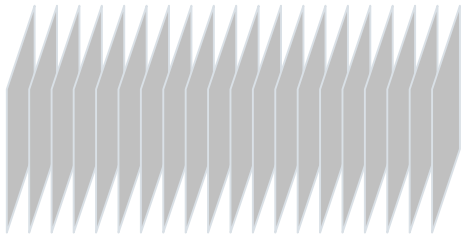
camera motion, motion trajectory, parametric motion, motion activity

- Other Descriptors

Face recognition

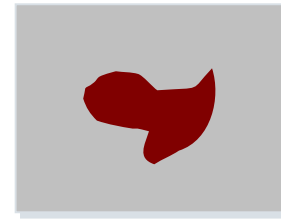
Low level Audio Visual descriptors

Video segments



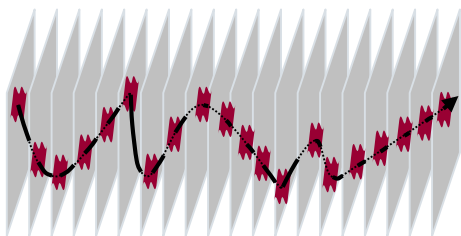
Color
Camera motion
Motion activity
Mosaic

Still regions



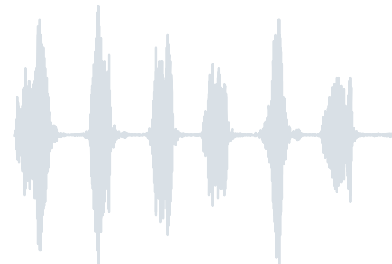
Color
Shape
Position
Texture

Moving regions



Color
Motion trajectory
Parametric motion
Spatio-temporal shape

Audio segments



Spoken content
Spectral characterization
Music: timbre, melody

Part 3: Basic Visual Structures

- Grid Layout
- 2D-3D Multiple View
- Time Series
- Spatial 2D Coordinates
- Temporal Interpolation

Part 4: Audio

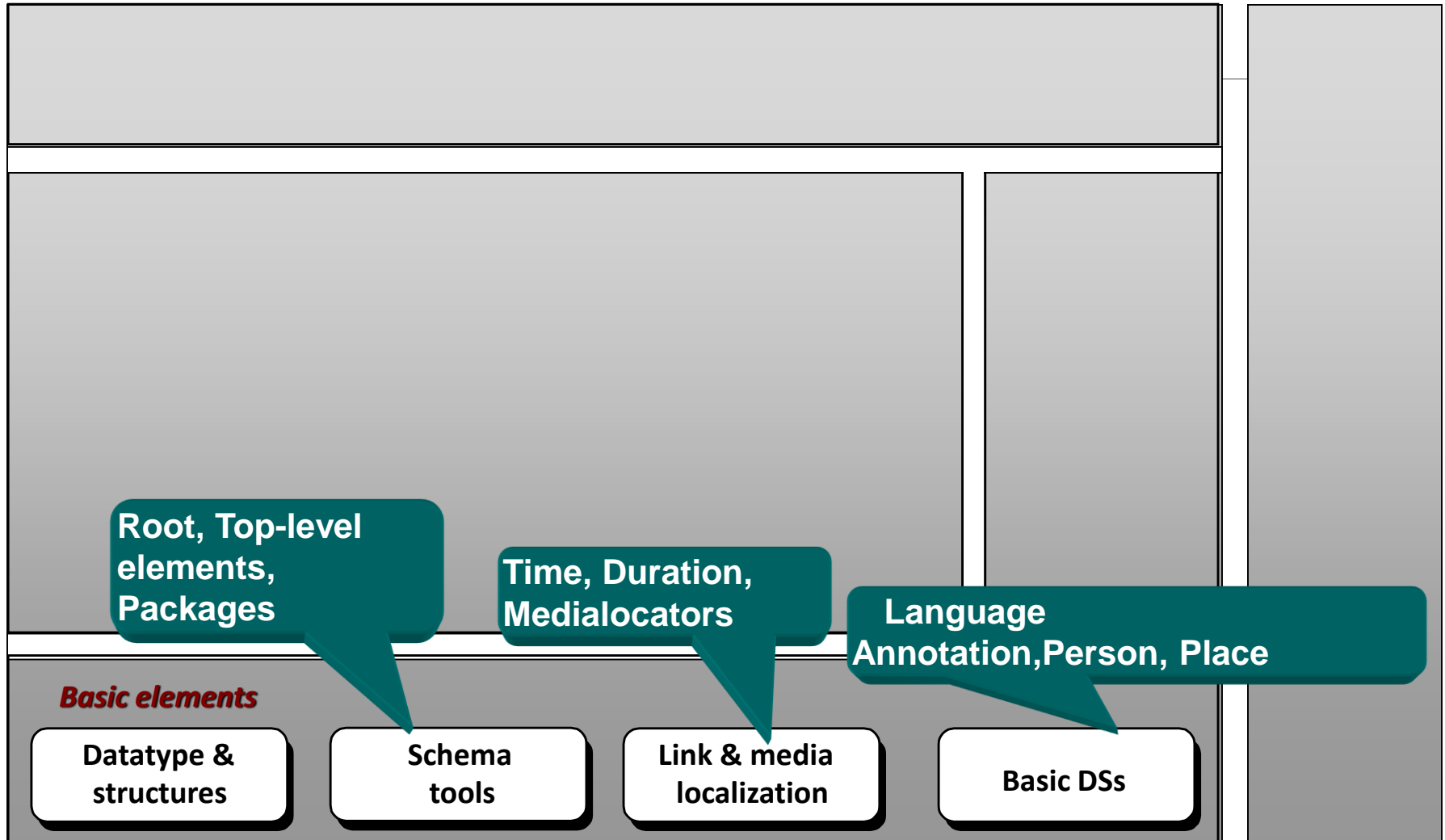
Specifies a set of standardized audio descriptors and description schemes.

- Sound Effects
- Music Instrument Timbre
- Spoken Content
- Melody Contour

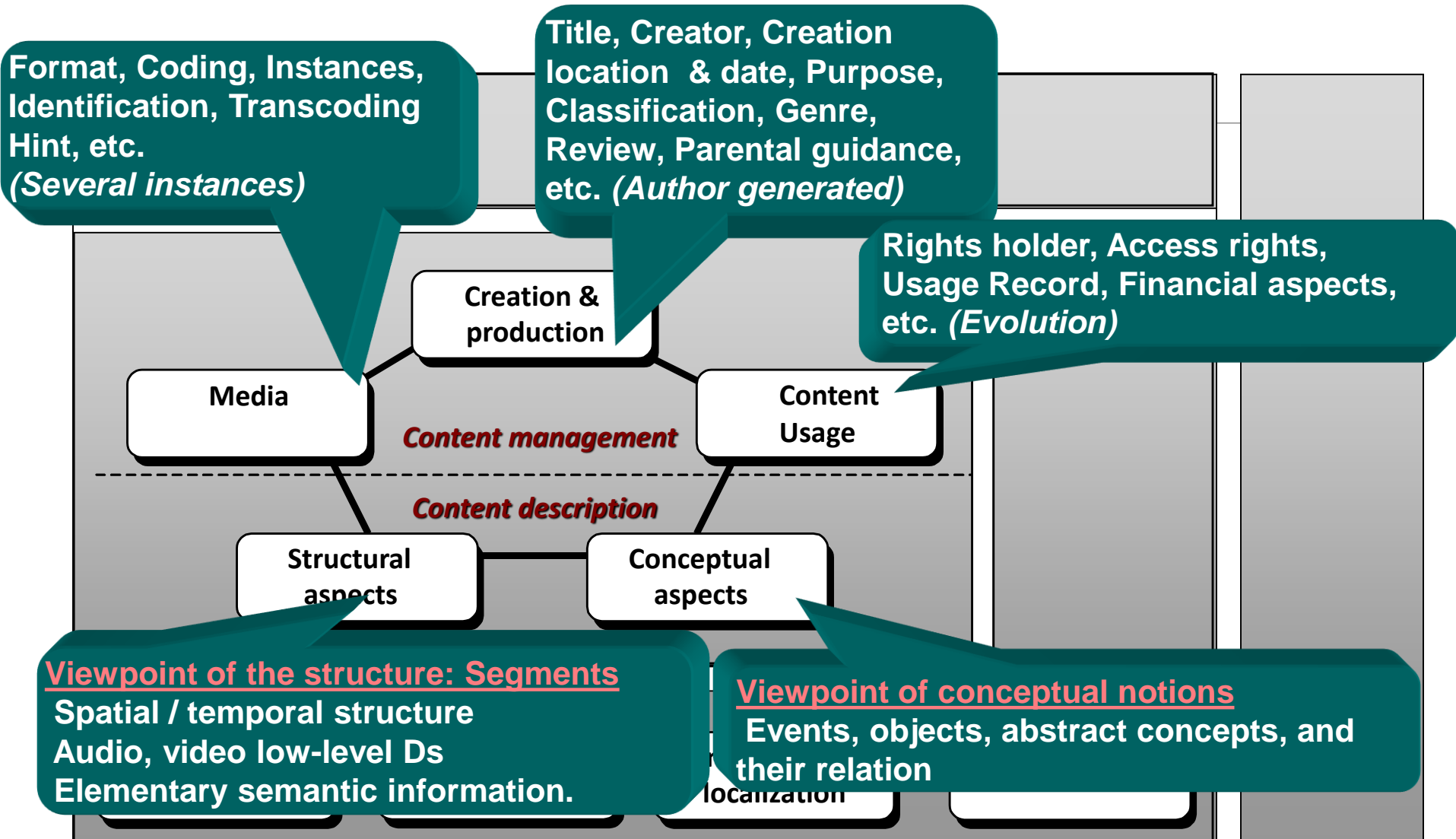
Part 5: Multimedia Description Schemes

- Specifies a high level framework
 - that allows generic description of all kinds of multimedia
 - including audio, visual, and textual data.

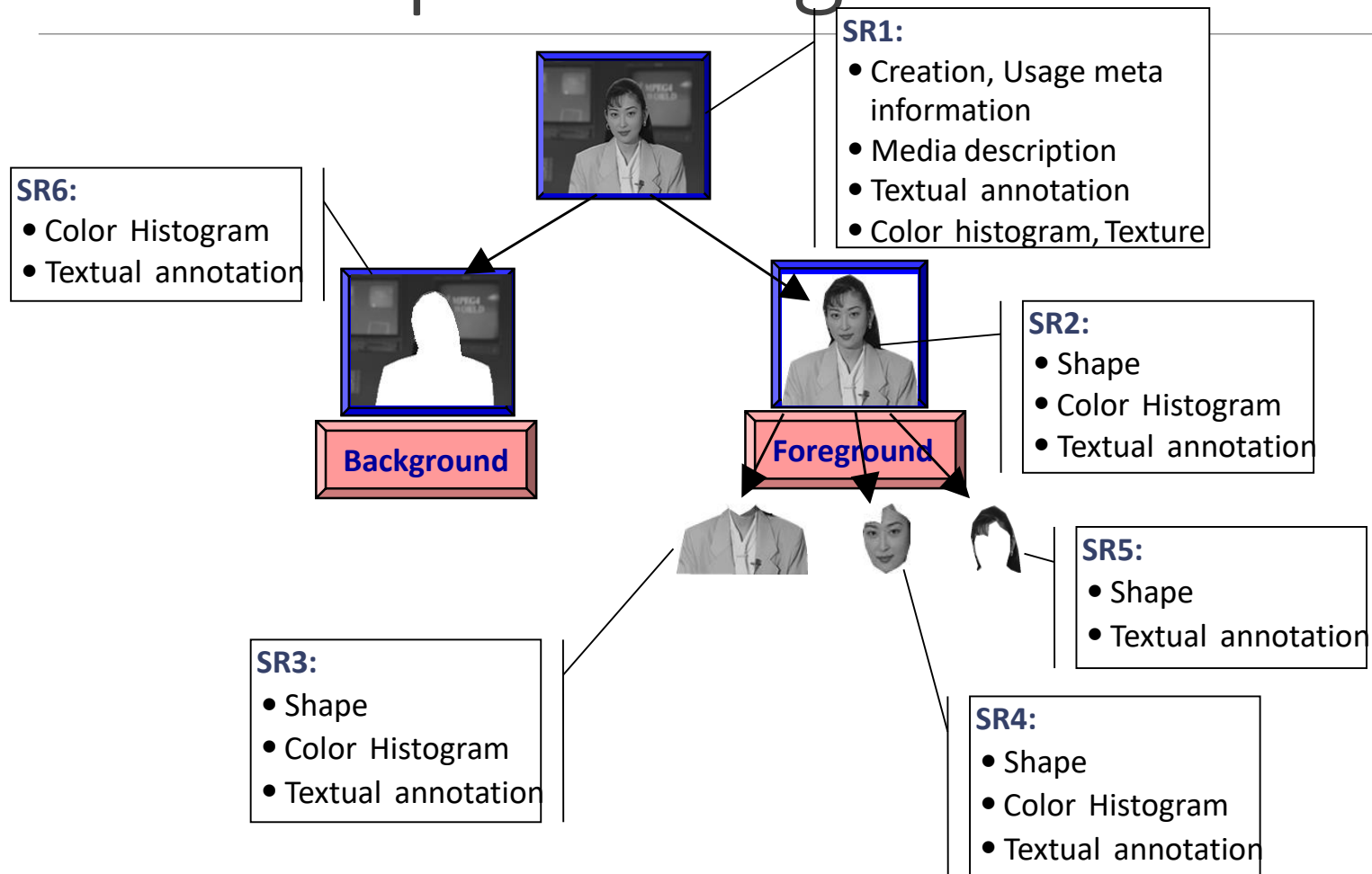
Part 5: MDS Basic Elements



MPEG 7: Content Management & Description



Example of Segment trees



Time
Axis

Segment Tree

Shot1

Shot2

Shot3

Segment 1

Sub-segment 1

Sub-segment 2

Sub-segment 3

Sub-segment 4

segment 2

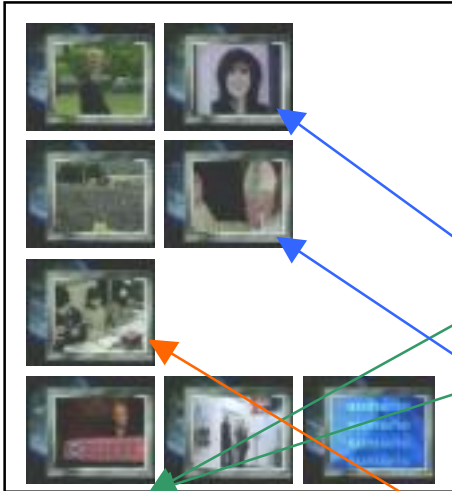
Segment 3

Segment 4

Segment 5

Segment 6

Segment 7



Semantic DS (Events)

• Introduction

• Summary

• Program logo

• Studio

• Overview

• News Presenter

• News Items

• International

• Clinton Case

• Pope in Cuba

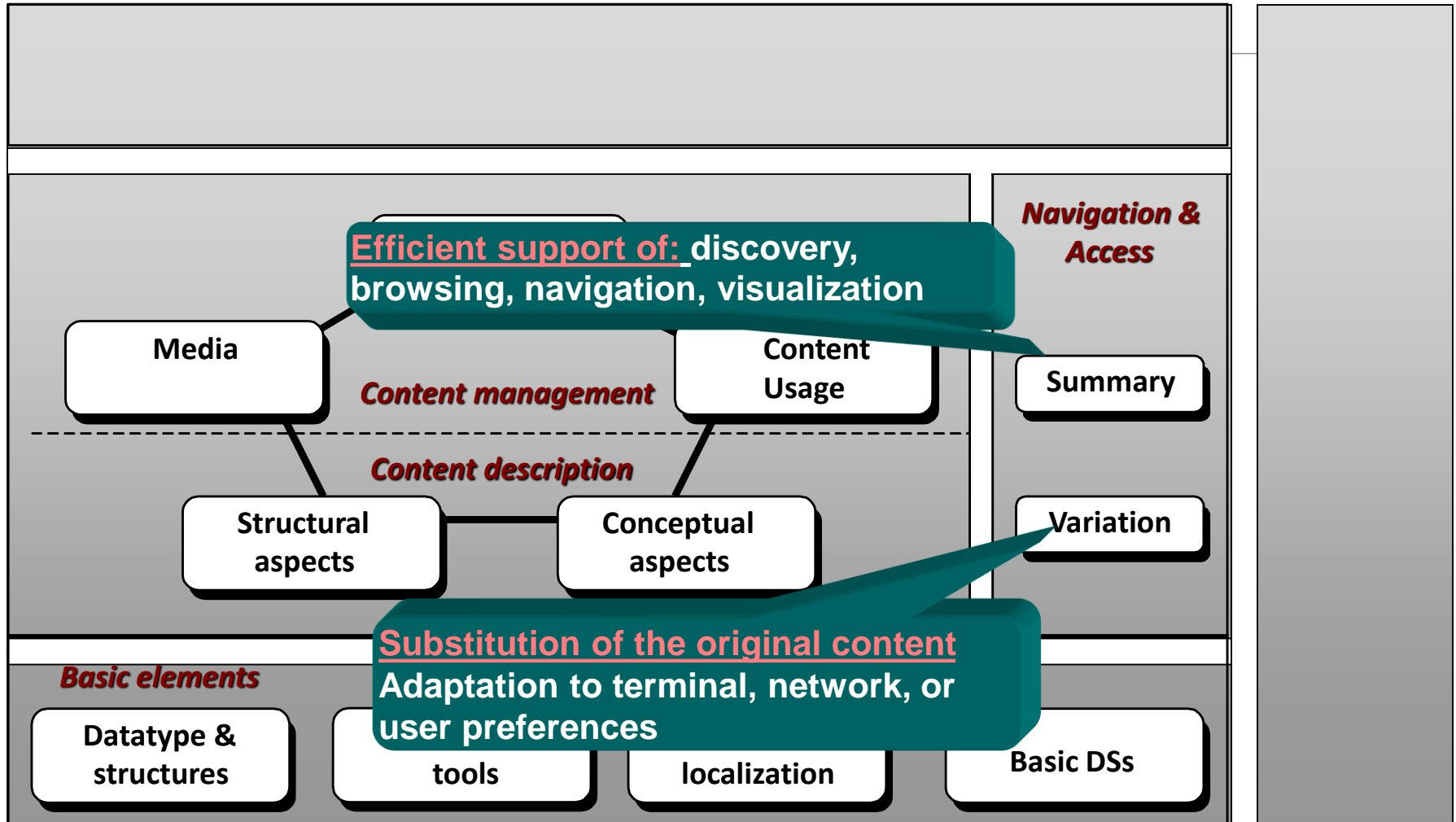
• National

• Twins

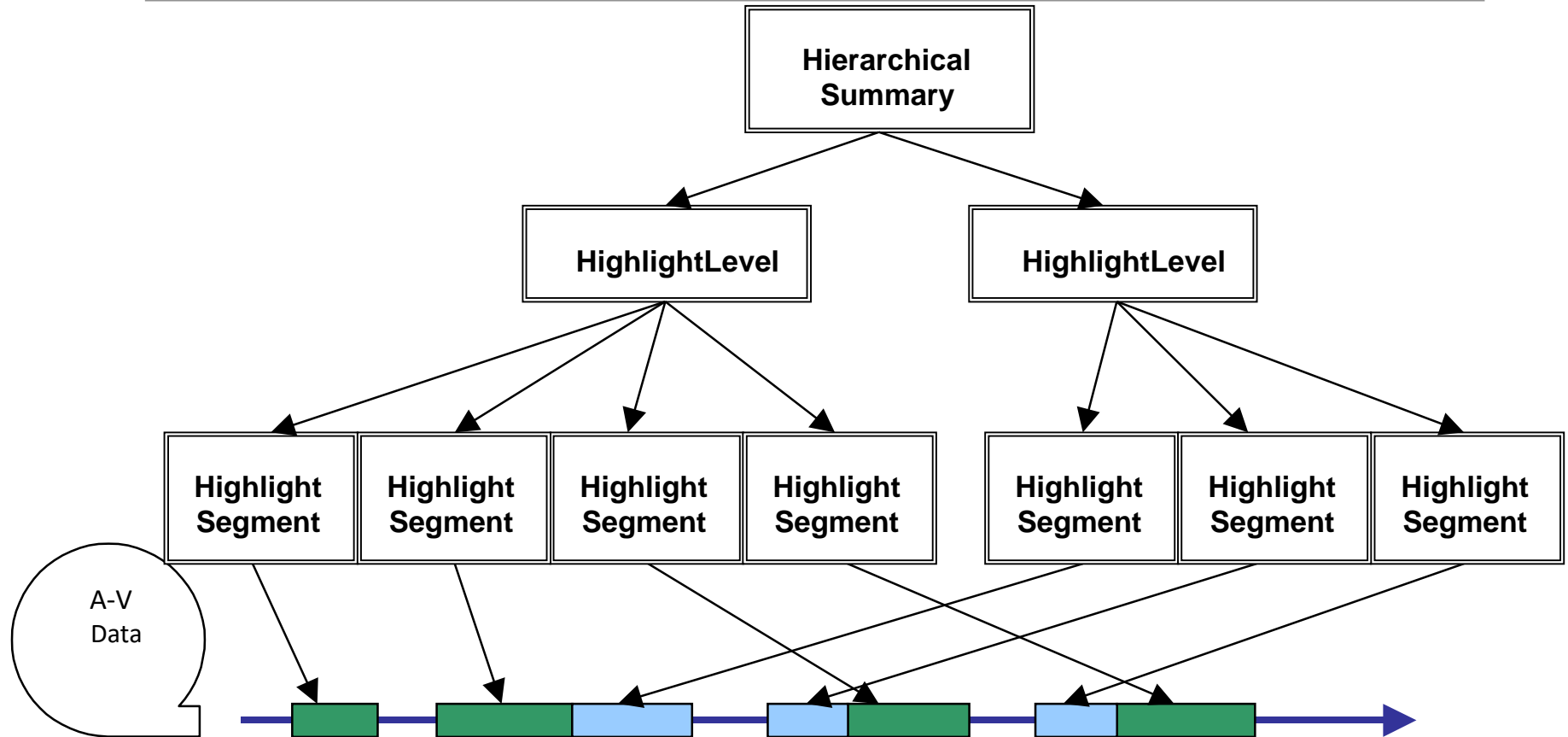
• Sports

• Closing

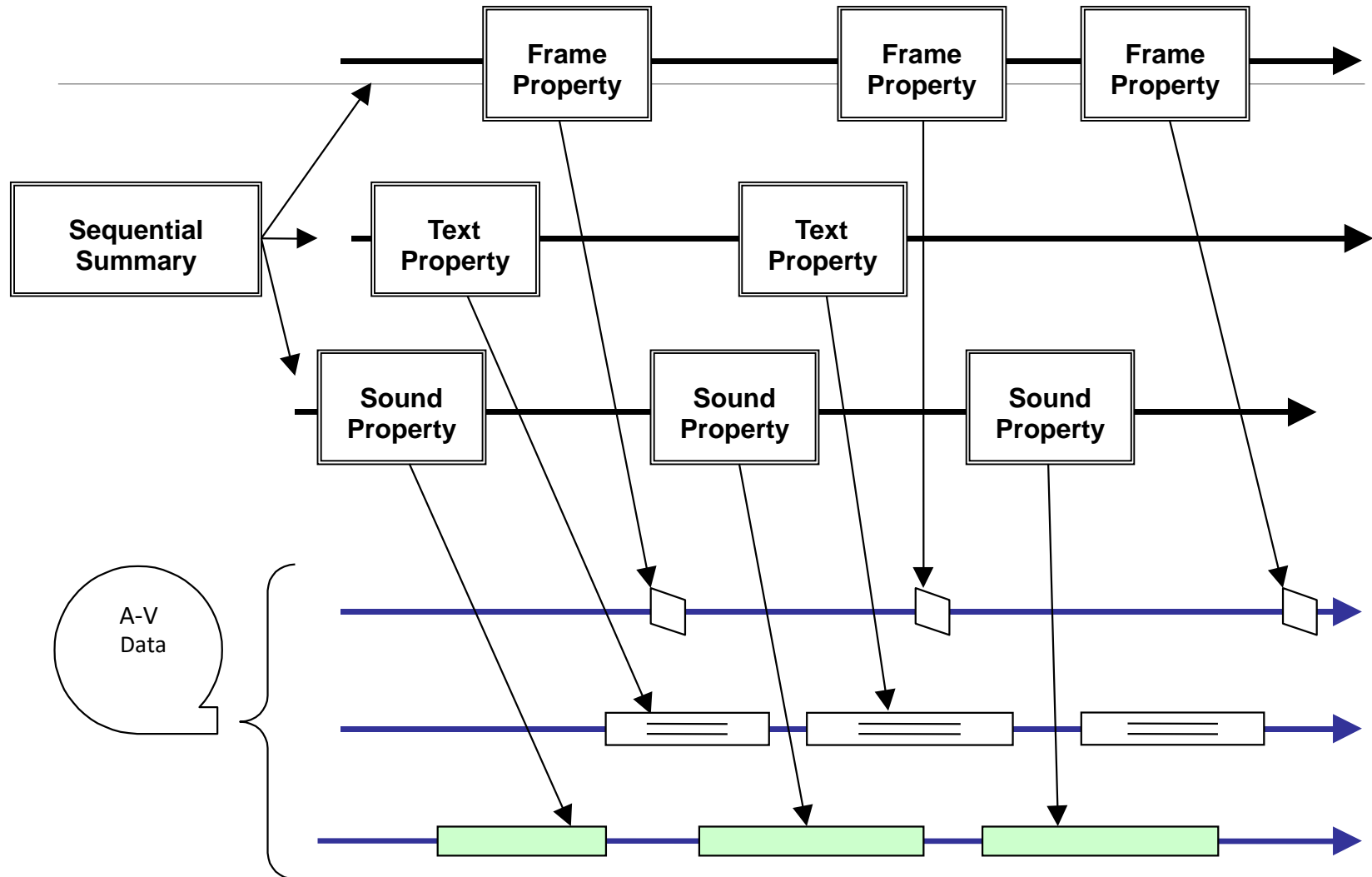
MPEG 7: Navigation and Access



MPEG 7: Hierarchical summary



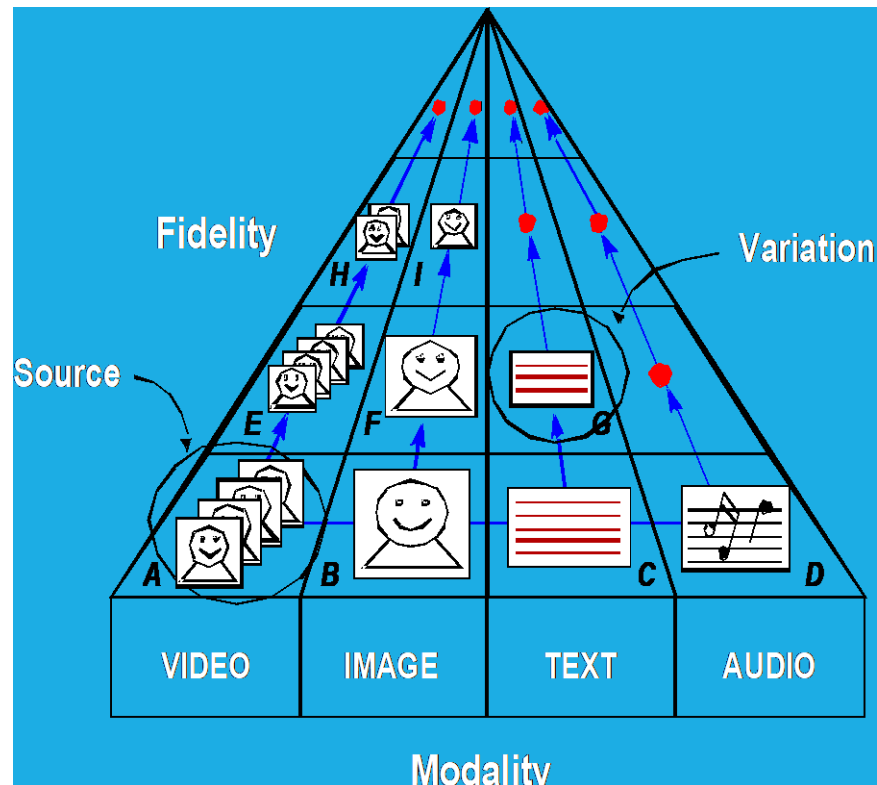
MPEG 7: Sequential summary



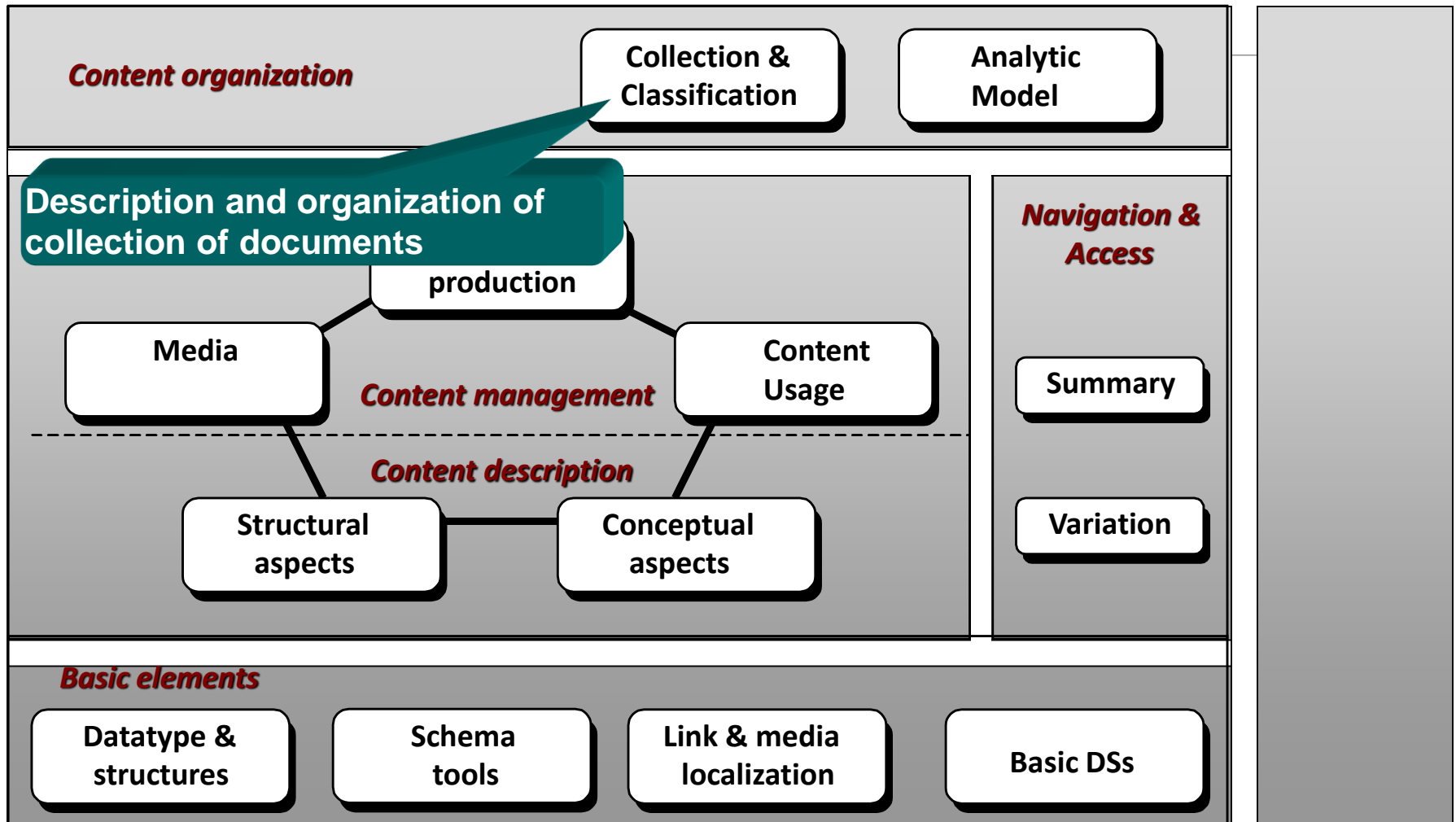
MPEG 7: Variation

Universal Multimedia Access

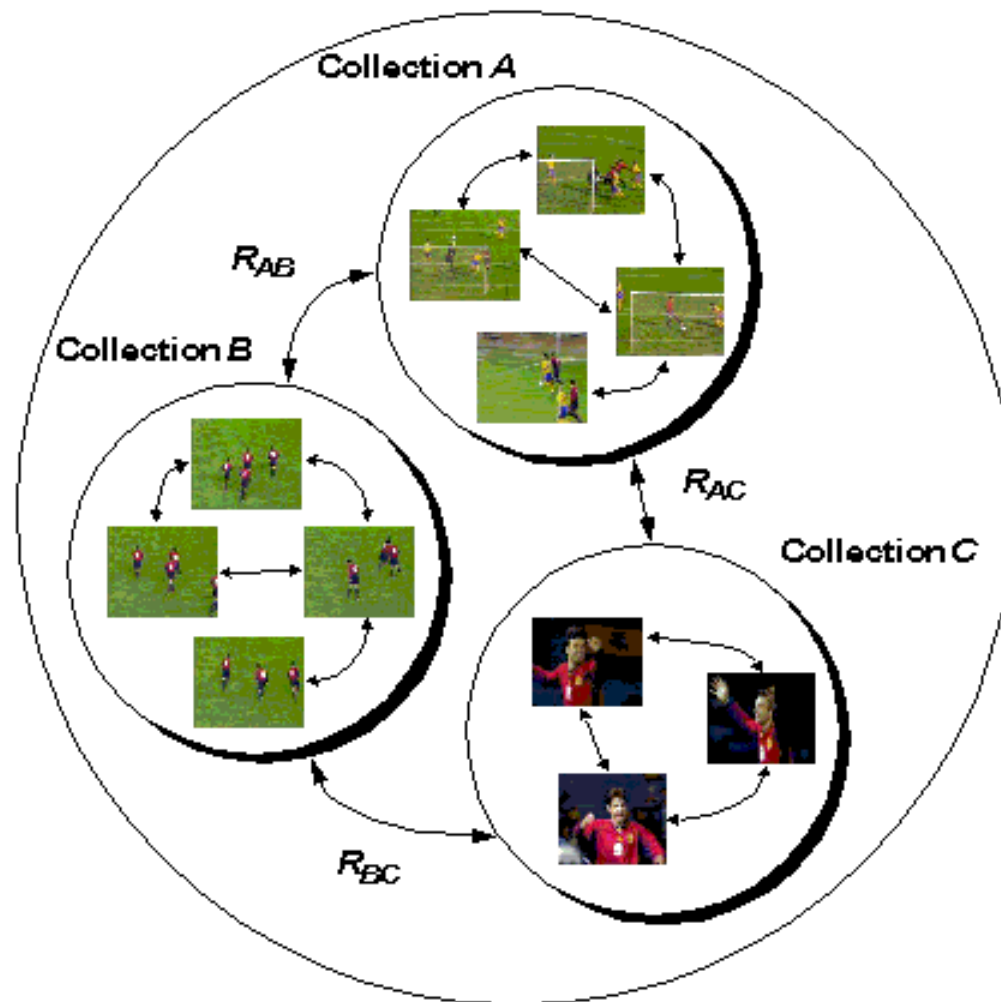
Adapt delivery to network and terminal characteristics (QoS)



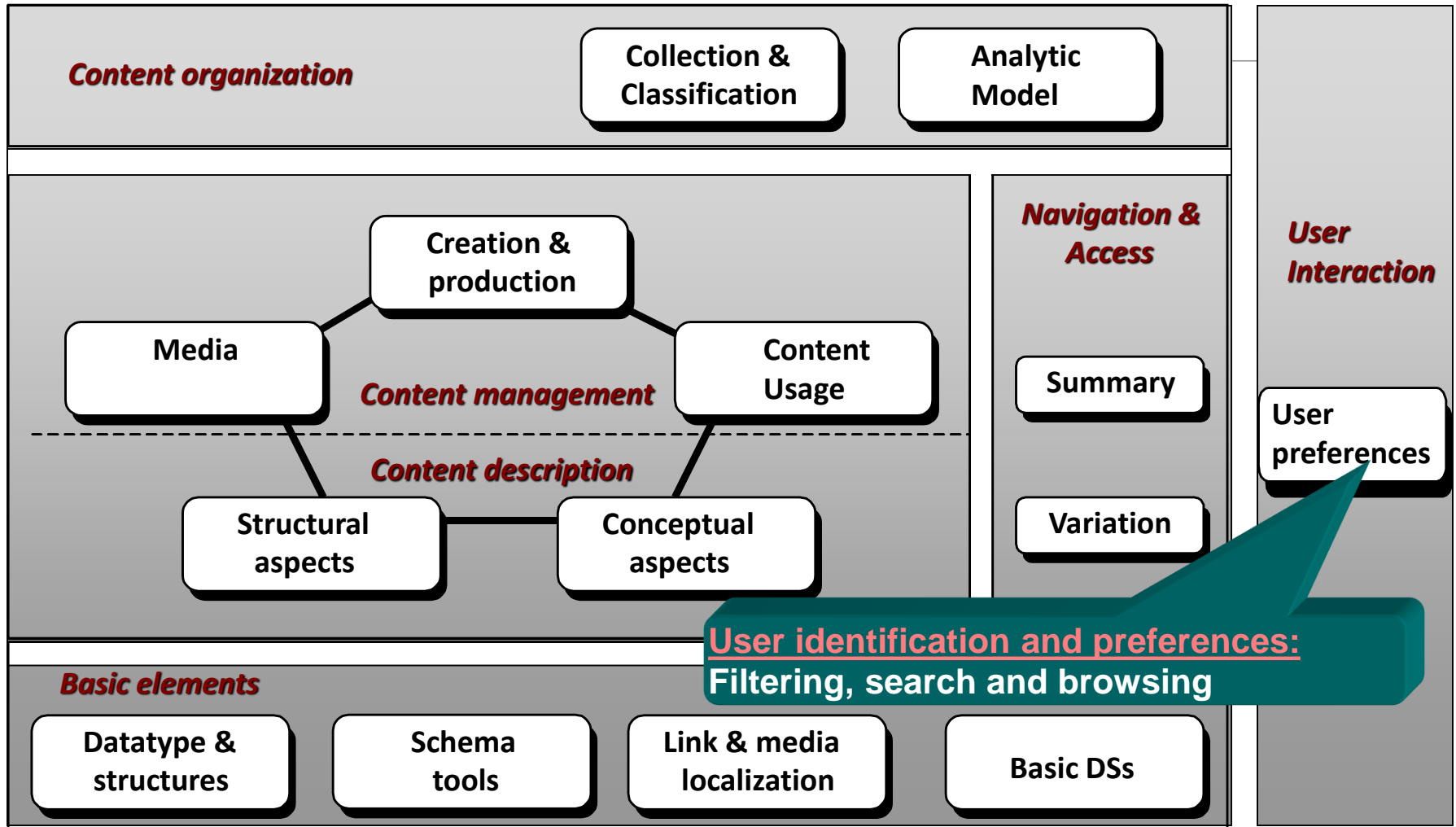
MPEG-7: Content Organization



Collection Structure



MPEG 7: User Interaction



MPEG-7: Its Relation with other standards

AHG on “Metadata harmonization”:

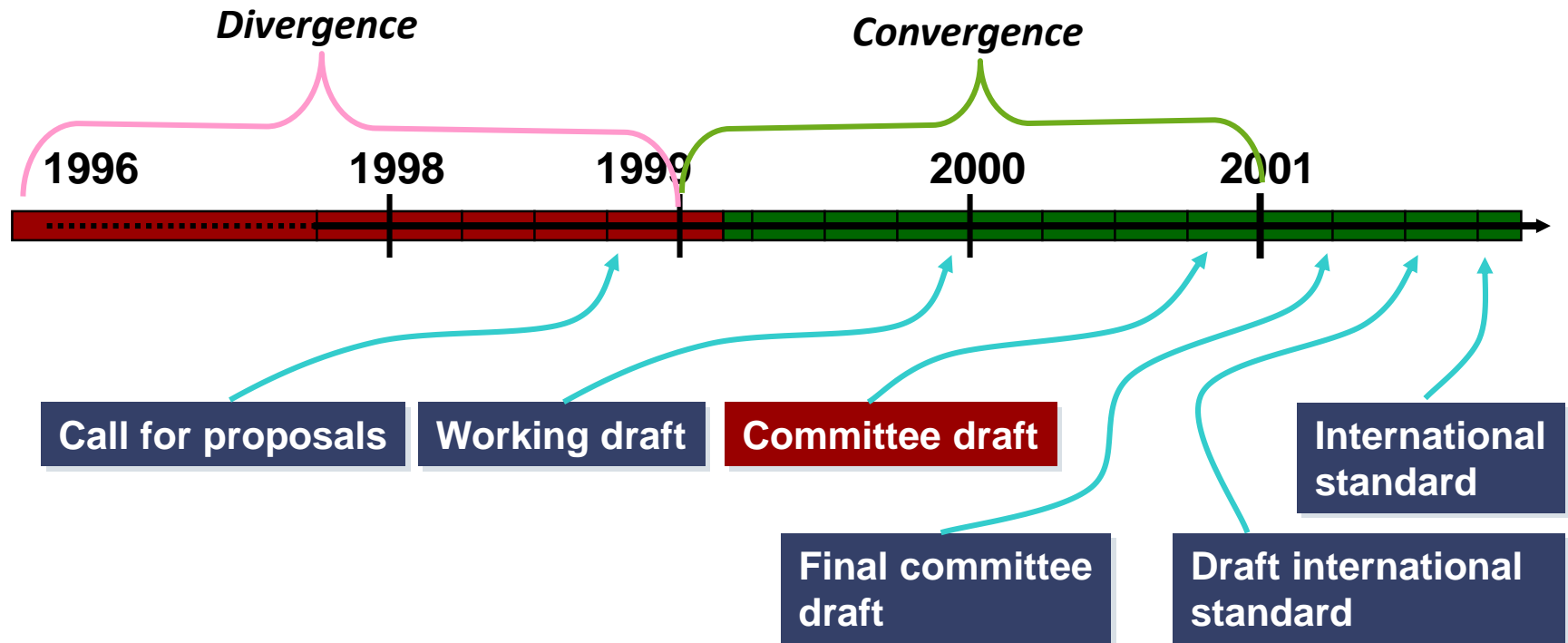
- SMPTE: Metadata dictionary, KLV encoding
- Dublin Core Metadata Initiative
- European Broadcast Union

AHG on TV AnyTime Application

Large number of Liaisons:

- SMPTE
- Dublin Core
- W3C (XML Schema)
- etc.

MPEG-7: TimeLine - The Work Plan



Conclusions on AV Content Description and MPEG-7

MPEG-7:

- AV content description for interoperable application

Description Definition Language:

- XML Schema (flexibility) + Binary version (efficiency)

Description Schemes:

- Library of description tools
- Covers a wide range of generic needs

Reference

<https://www.wisdomjobs.com/e-university/multimedia-tutorial-270/mpeg-7-12917.html>

Q & A
