Multimedia Databases
Multimedia Data Modeling

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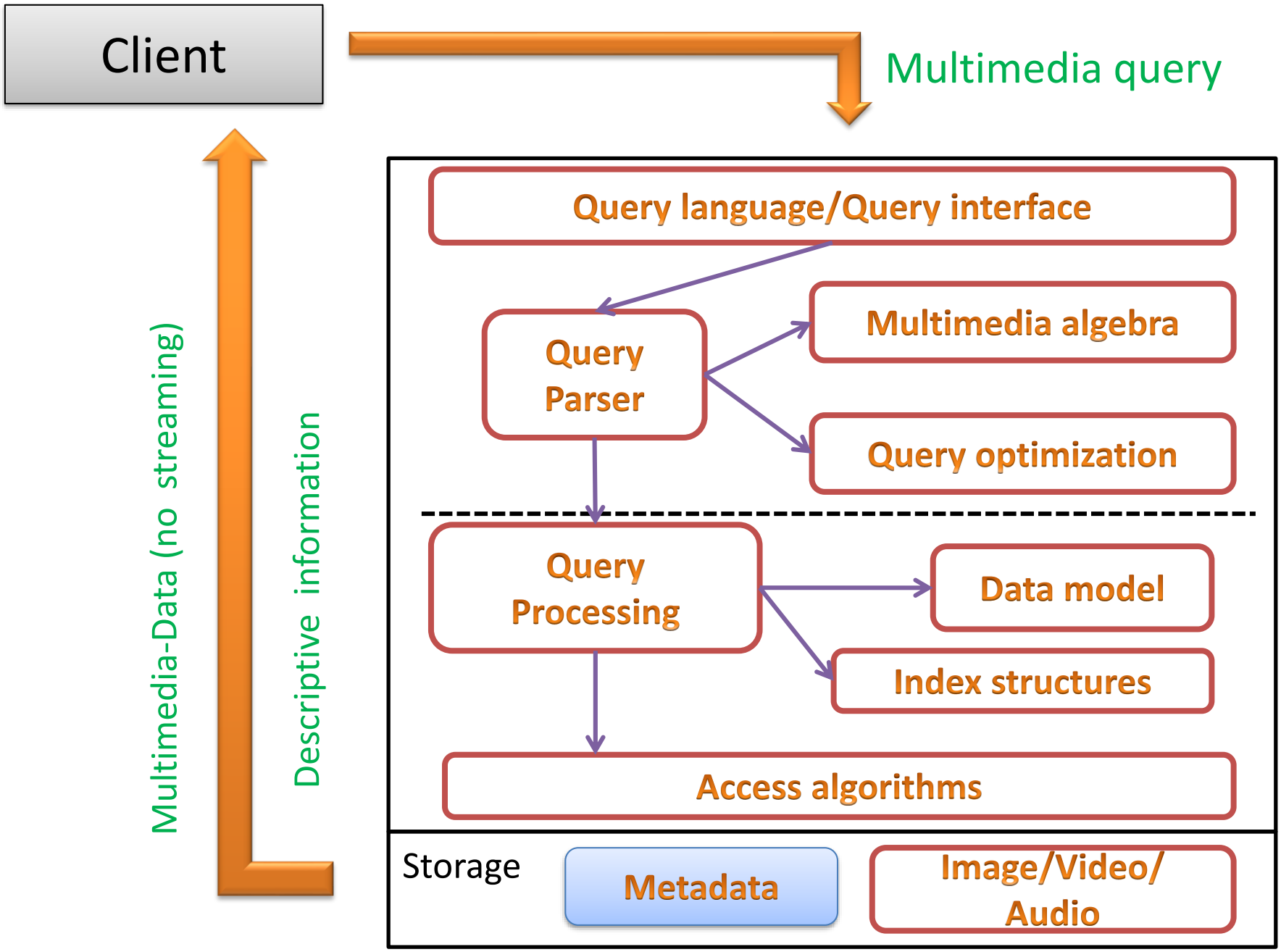
Multimedia Modeling


Client
Multimedia query
Multimedia-Data (no streaming)
Descriptive information
Query language/Query interface
Query Parser
Multimedia algebra
Query optimization
Query Processing
Data model
Index structures
Access algorithms
Storage
Metadata
Image/Video/ Audio
Multimedia database system

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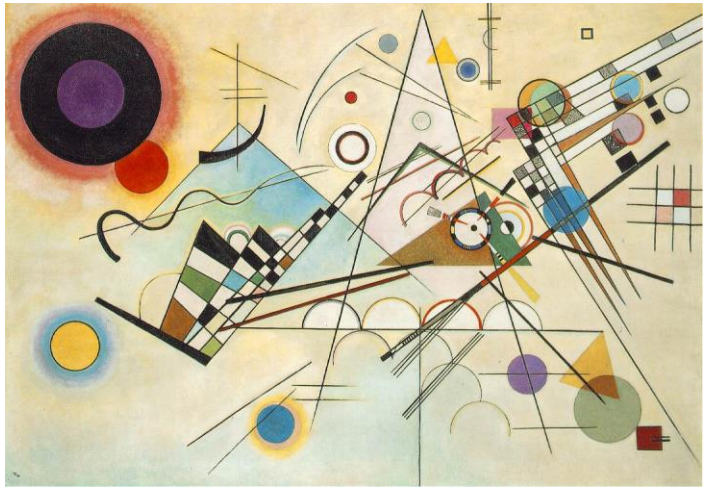
Multimedia Modeling

Multimedia Annotation

Problem description

- How would you describe these images? What are the problems?



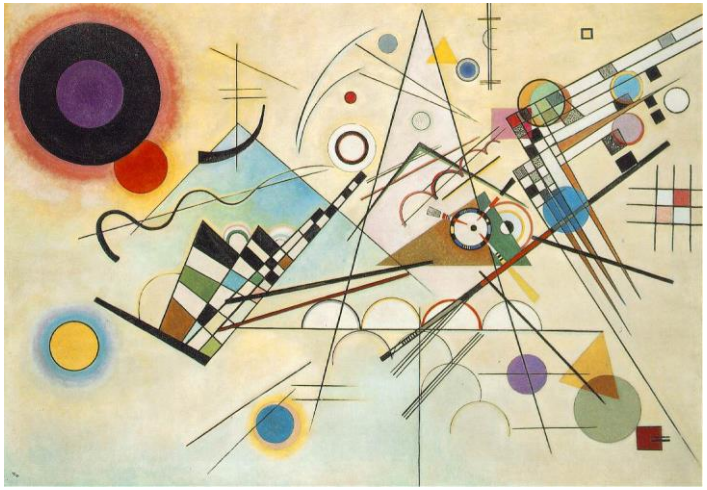
www.whitehouse.gov

- „A picture is worth a thousand words“
  - Can words really describe pictures?
    - Different viewers → different descriptions

Multimedia Annotation

Definition

Multimedia annotation is the task of associating textual labels or tags to multimedia objects in order to represent their (semantic) content.



Kandinski Komposition 8

Beautiful 1923 Abstract

Guggenheim Composition VIII

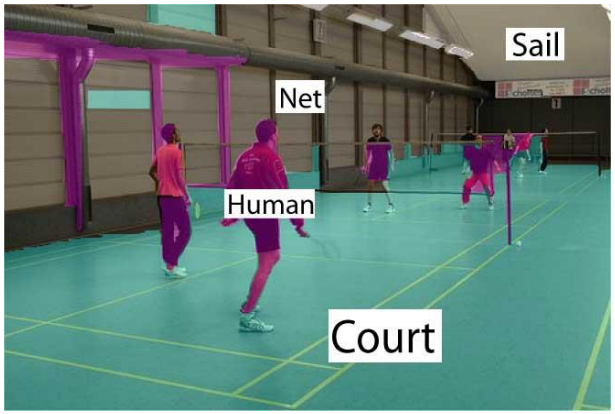
Colorful Oil on canvas Painting

Bauhaus Cercle Dreieck

Multimedia Annotation

Characteristics and Challenges

- Manual, automatic or semi-automatic



- Hard problem due to:
  - Ambiguity / differing user perspectives and contexts…
  - Sensory gap
  - Semantic gap

Multimedia Annotation

The Sensory Gap

"The sensory gap is the gap between the object in the world and the information in a description derived from a recording of that scene"

(Smeulders et al 2000).

- Uncertainty about the status of objects in a scene
- Particularly poignant when knowledge about the recording conditions is missing.

- 2D recordings of different 3D objects can be the same (red ball - red sun)
- Interpretation by humans may be wrong due to lack of information
- etc.

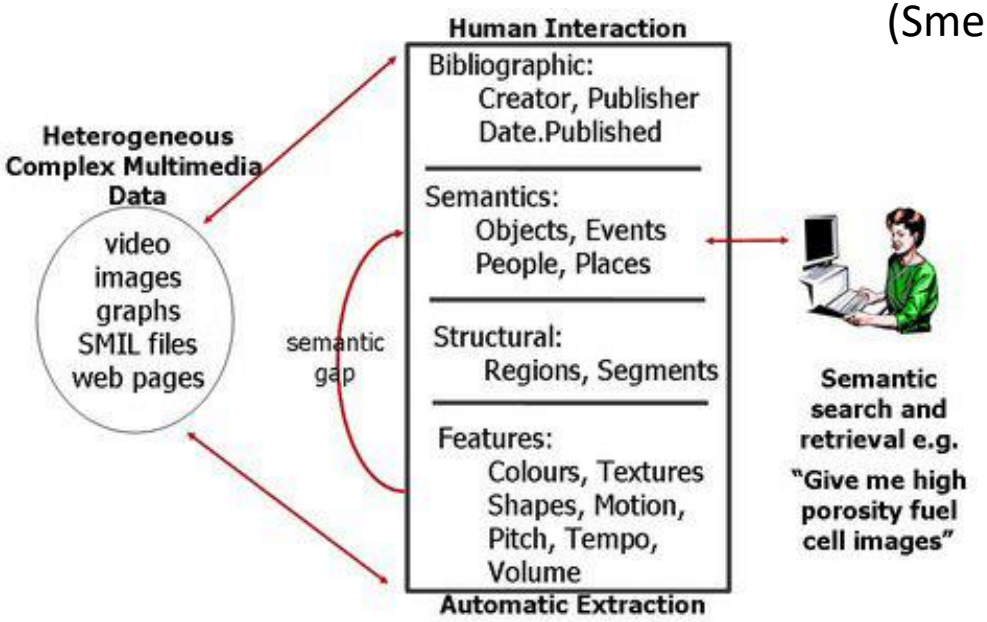
How many arms does she have??

Multimedia Annotation

The Semantic Gap

"The semantic gap is the lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation."

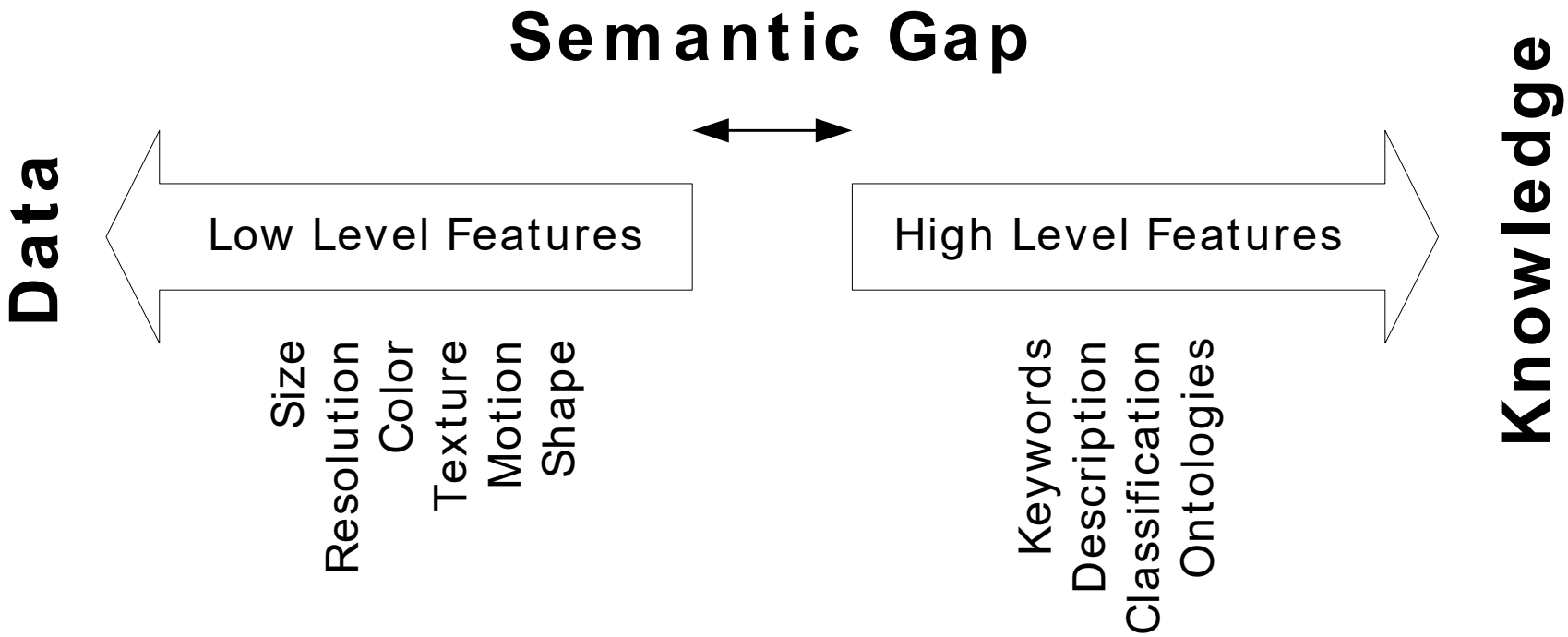
(Smeulders et al. 2000)



Arnold W. M. Smeulders, Marcel Worring, Simone Santini, Amarnath Gupta, and Ramesh Jain. Content-based image retrieval at the end of the early years. IEEE Trans. Pattern Analysis Machine Intelligence, 22, 2000.

Multimedia Annotation

The Semantic Gap



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Multimedia Modeling

Multimedia Metadata

Definition

- What is metadata?
  - "Data about data"
  - *Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource* [1]

- Multimedia Metadata: *Multimedia metadata formats support the description of multimedia data in terms of: what the content is, who created it, how it can be processed, etc.* [2]

Sources:

[1] NISO Press. *Understanding meta data*. National Information Standards Organization, 2004. [online] http://www.niso.org/publications/press/UnderstandingMetadata.pdf

[2] M. Hausenblas eds. *Multimedia Vocabularies on the Semantic Web*. W3C Multimedia Semantics Incubator Group Report, 2007.

Multimedia Metadata

Related issues (1)

- Interoperability
  - Complexity of the metadata vs. integration with (different) applications
  - Different formats, different degrees of expressiveness
- Digital preservation
  - Readability in 100, 1000 years
  - How do you decode the descriptions, etc.
- Transmission
  - Synchronization, compression, etc.

Multimedia Metadata

Related issues (2)

- Relevance of metadata, updates
  - Annotations of different users
  - Alteration of the content during / after editing

- Production
  - Manual vs. Semi-automatic vs. Automatic

➢ Case for standardized metadata formats

Metadata Characteristics

Storage

- Metadata can either be:
  - **Extrinsic**: exist independent of the described primary data. Usually in an indexed database, file system, etc.
  - **Intrinsic**: exist as an integral part of the primary data.
- Related metadata formats: e.g. EXIF (intrinsic), MPEG-7 (extrinsic)

Metadata Characteristics:
Categories of Information (1)

- Content description
  - General description, keywords, summaries, etc.
- Administrative metadata
  - Creators, version, contributors, etc.
- Structural metadata
  - Content segmentation

Metadata Characteristics:
Categories of Information (2)

- Legal metadata
  - Copyright, usage rights, etc.
- Technical metadata
  - File format, codec, encryption, resolution, etc.
- Low-level features
  - Color histogram, texture characterization, etc.
- … and more

➢ Case for standardized representation (again!)

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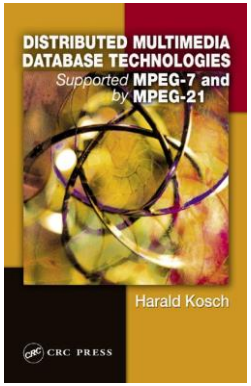
Multimedia Modeling

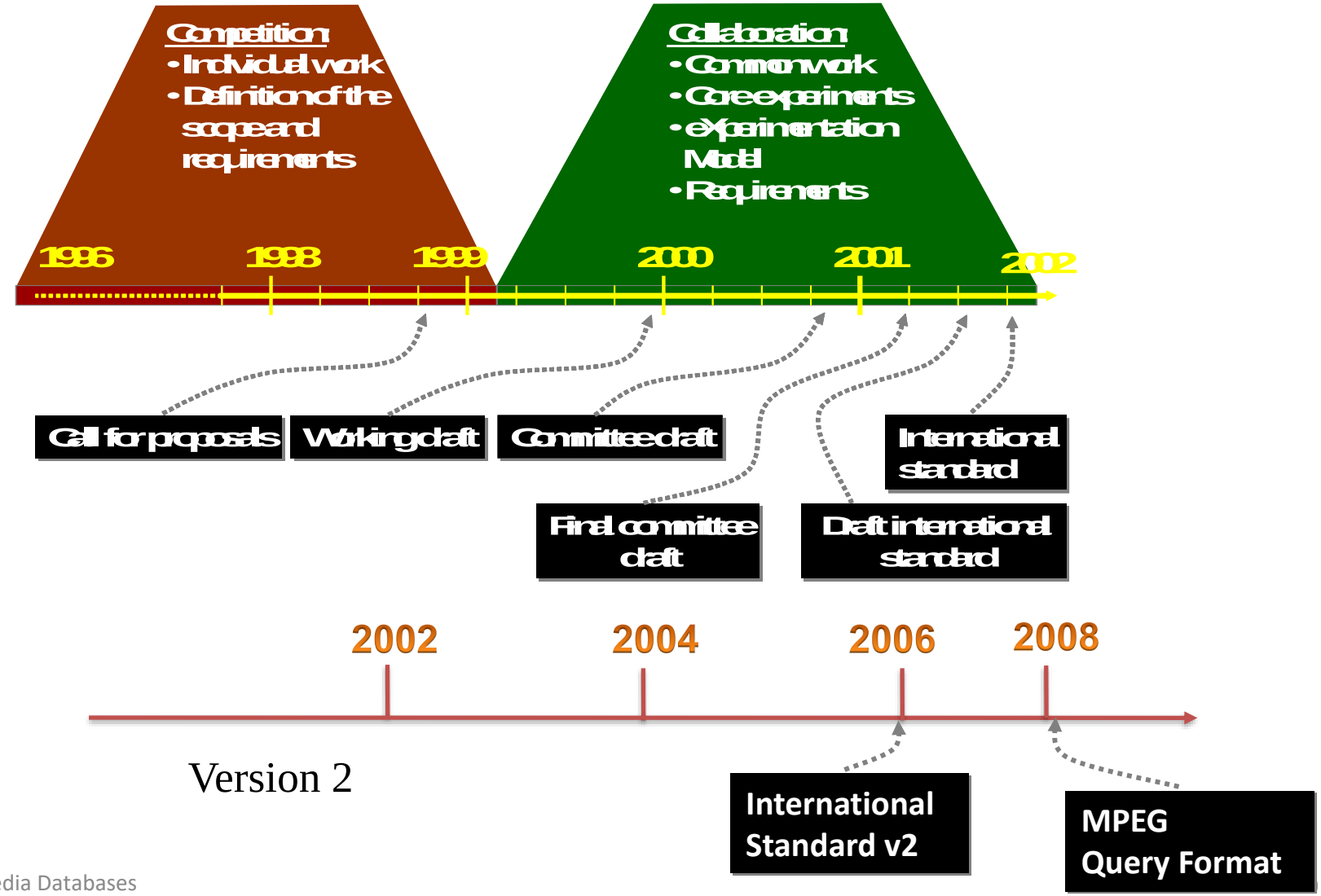
MPEG-7

Main Characteristics

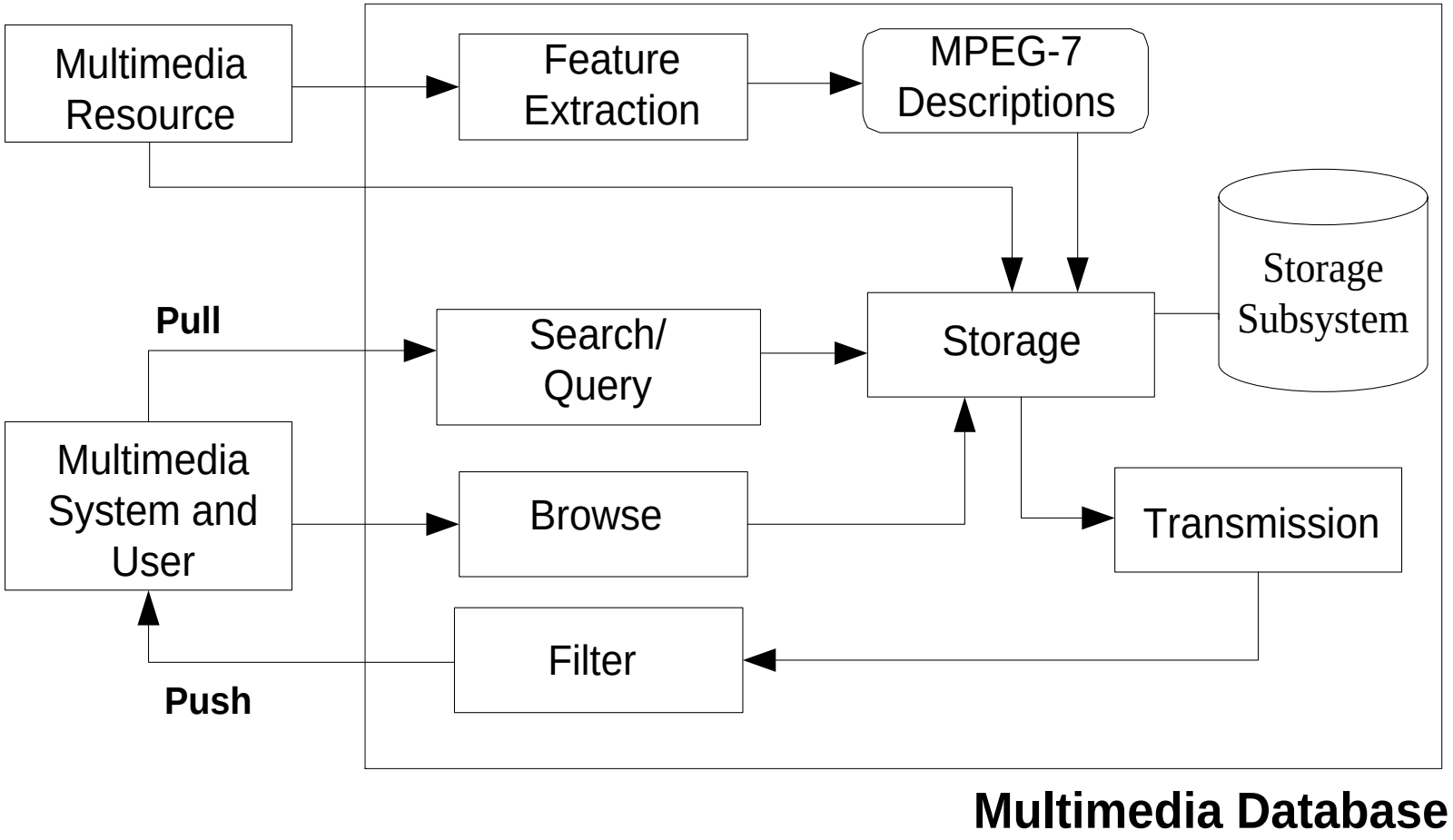
- ISO/IEC Standard since 2001 (2006 2. Version)
- "Almost complete" multimedia metadata representation format
  - Covers the whole metadata life cycle
- Designed for interoperability
- Provides a schema for multimedia databases



MPEG-7 History



MPEG-7 Database Integration



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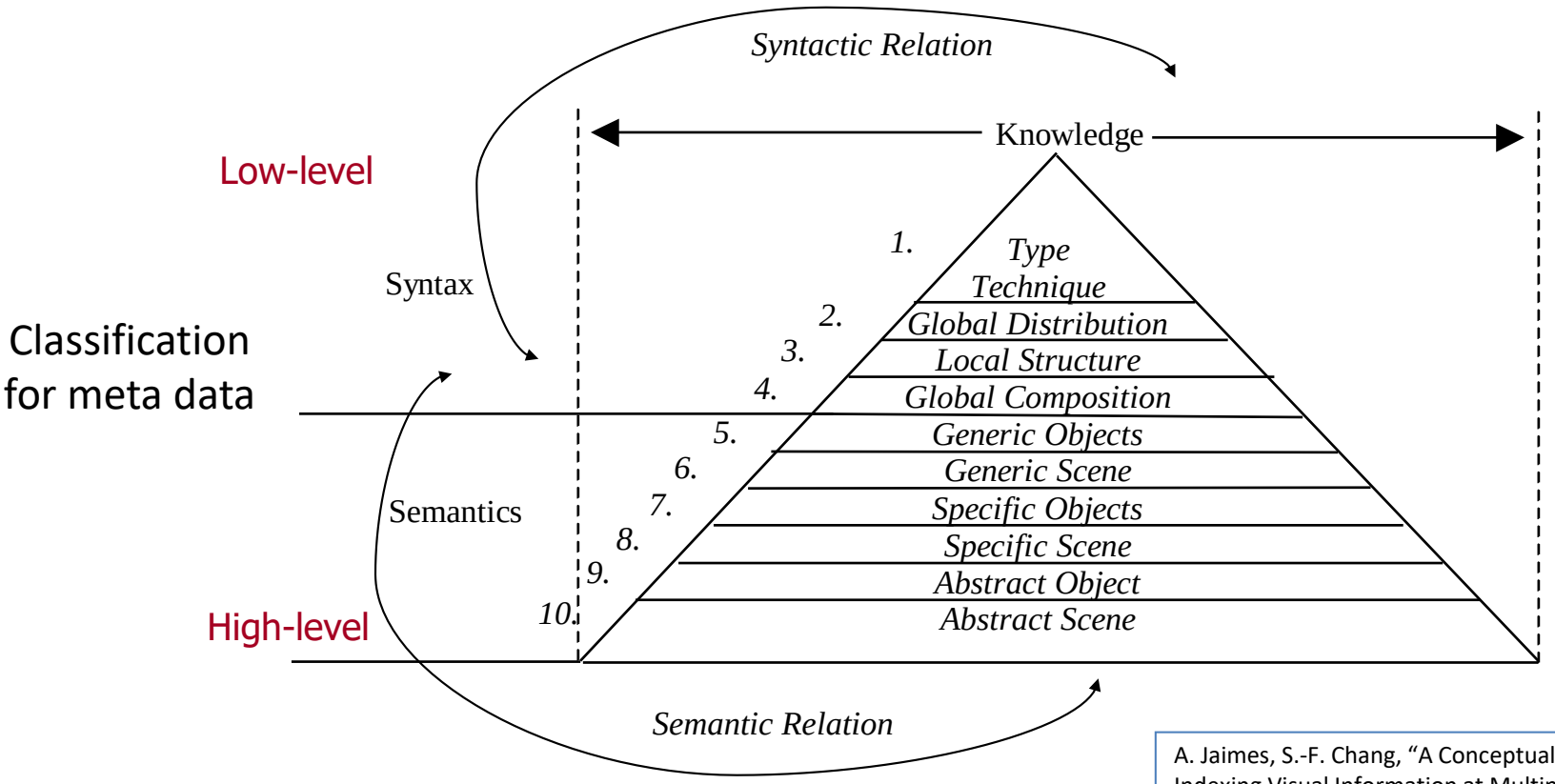
Multimedia Modeling

MPEG-7 Indexing Pyramide

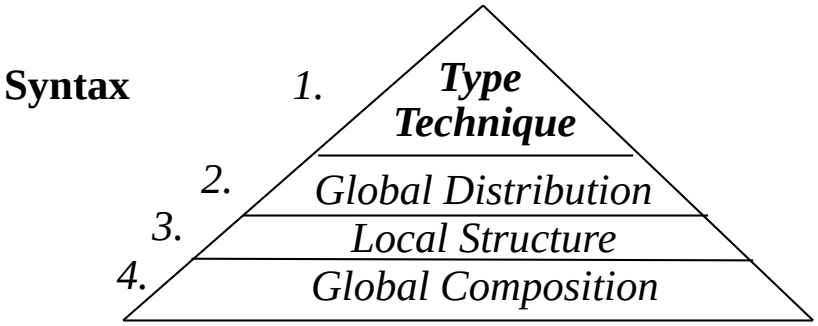
- **Multi-level (Visual) Indexing Pyramid** [Jaimes2000] (**Basic** for MPEG-7 Semantic Tools)

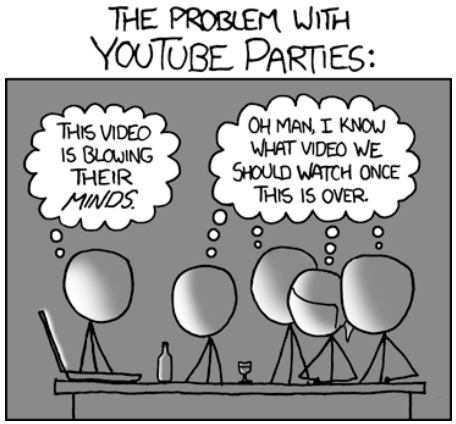


A. Jaimes, S.-F. Chang, "A Conceptual Framework for Indexing Visual Information at Multiple Levels", IS&T/SPIE Internet Imaging, Jan. 2000.

MPEG-7 Indexing-Pyramide – Level 1

- Type/Technique





Cartoon, black white

(xkcd.com)

- Technique of production
- General visual characteristics

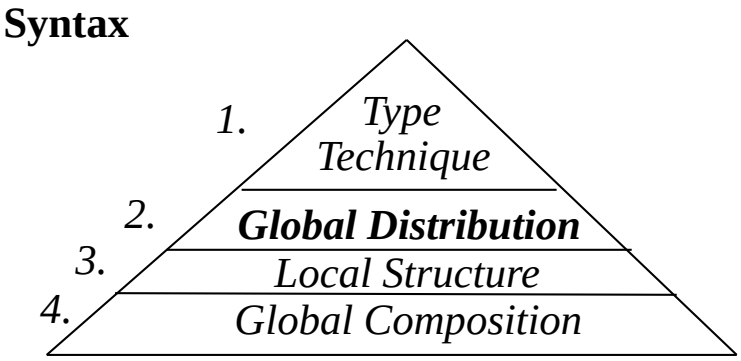
- example:
  - Colored or black/white image

Crowned Eagle by N Myburg. Photo courtesy Roberts Multimedia Birds CD-ROM

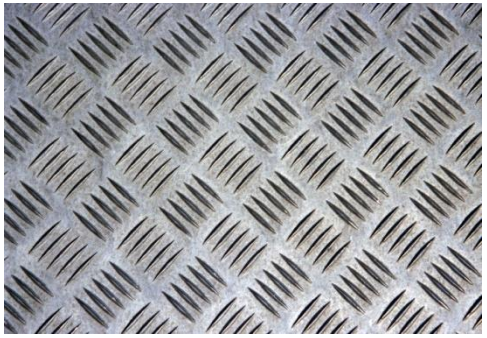
Image colored

MPEG-7 Indexing-Pyramide – Level 2

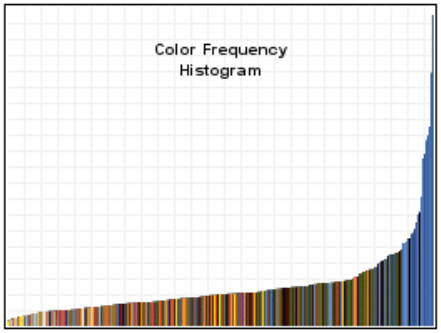
- Global distribution



- Distribution of low-level Features
  - Color information
    - Dominant color, …
  - Texture
  - Shape,
  - …



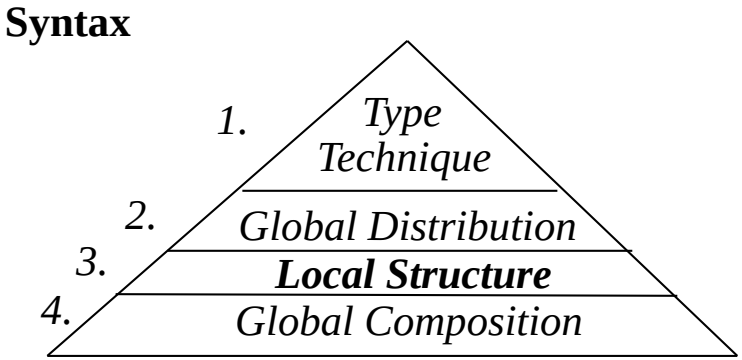
Texture

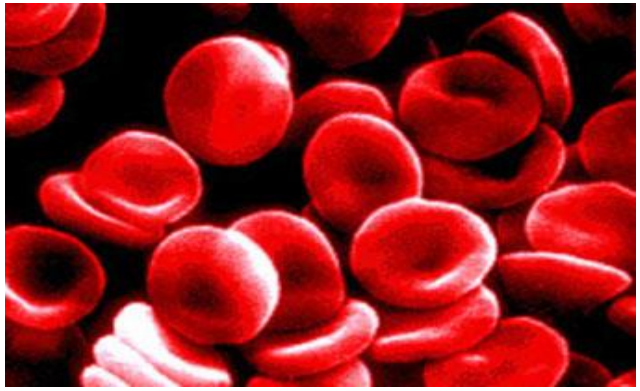


Color histogram

MPEG-7 Indexing-Pyramide – Level 3

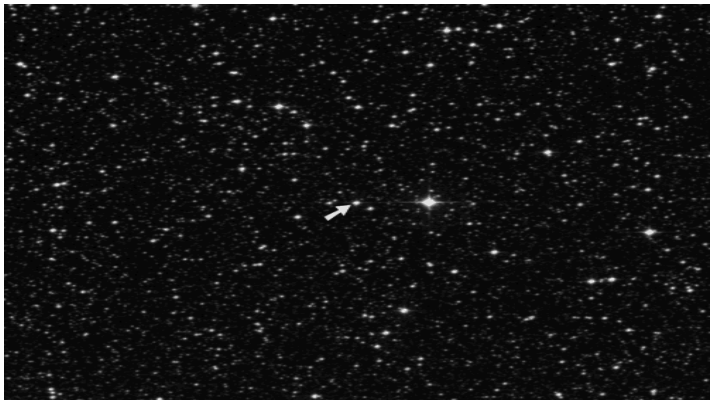
- Local Structure





Blood cell = circle

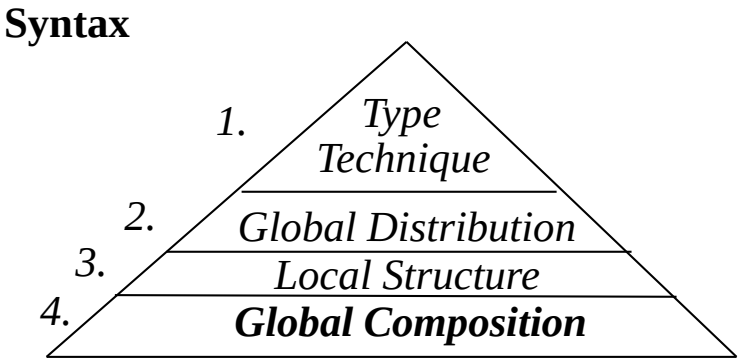
- Extraction of visual basic elements (circle, line)



star = point

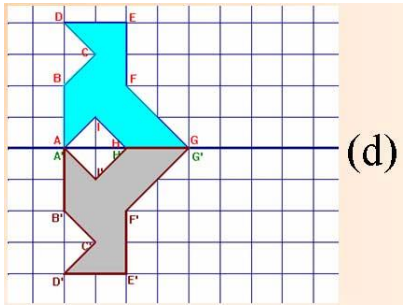
MPEG-7 Indexing-Pyramide – Level 4

- Global Composition



- Focusing of important image elements

centralized object

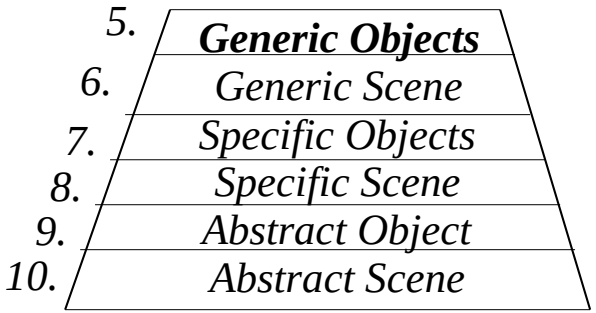


(horizontal) Symmetry

MPEG-7 Indexing-Pyramide – Level 5

- Generic Objects

Semantic



- Common knowledge about objects
- General tags and categories

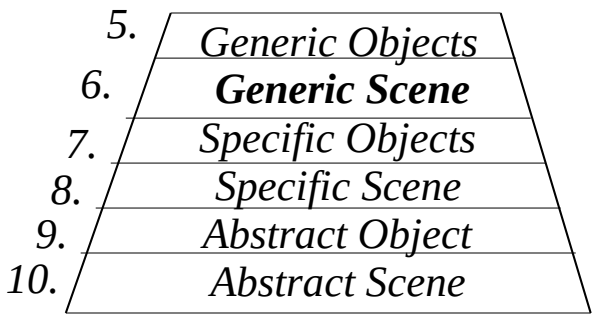
Comic figure

cat

MPEG-7 Indexing-Pyramide – Level 6

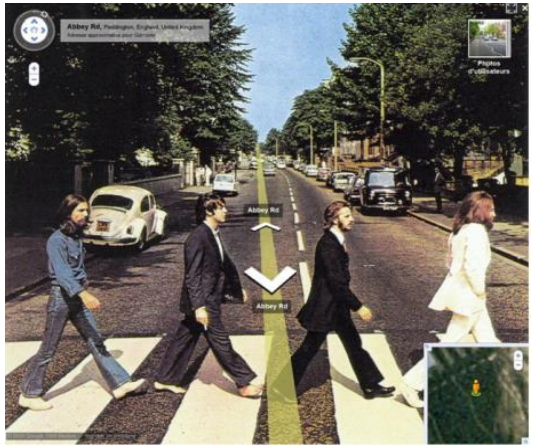
- Generic scene

Semantic



- Generic information about location

outdoors

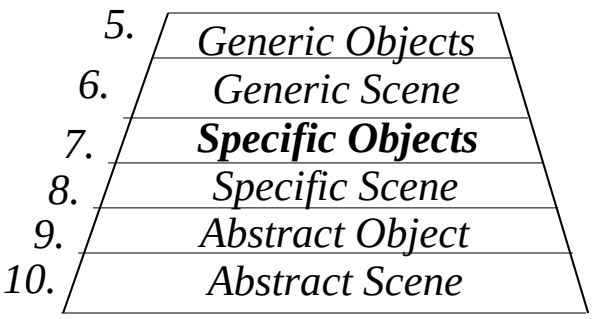


street

MPEG-7 Indexing-Pyramide – Level 7

- Specific Objects

Semantic



- Named entities
- Specific knowledge about objects
  - Flag of Germany
  - Davids shirt

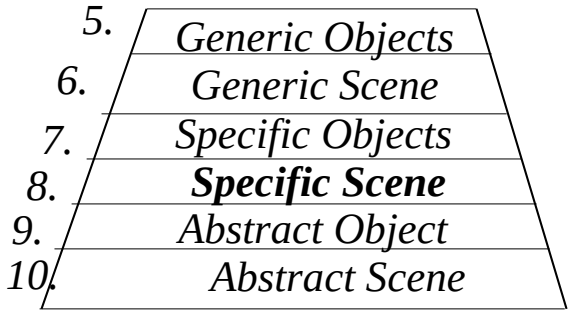
Silver Surfer

Thierry Henry

MPEG-7 Indexing-Pyramide – Level 8

- Specific Scene

Semantic



- Named location
- Specific information about location

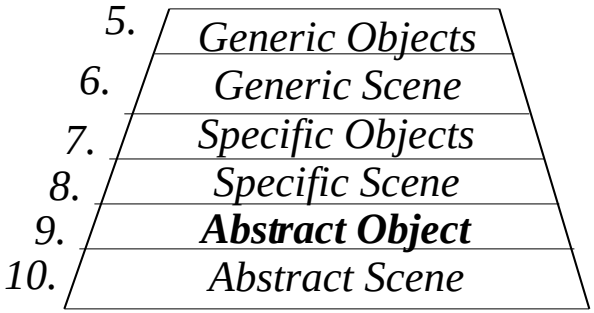
Passau

Allianz Arena

MPEG-7 Indexing-Pyramide – Level 9

- Abstract object

Semantic



- Meaning of objects

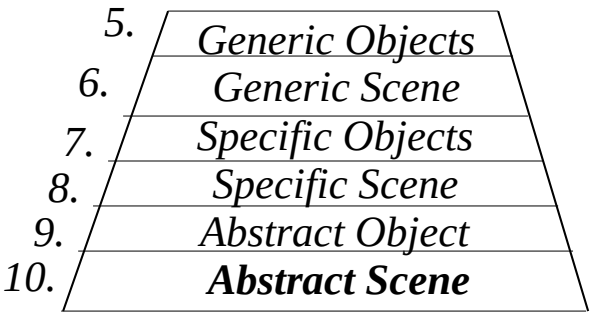
ecology

music

MPEG-7 Indexing-Pyramide – Level 10

- Abstract Scene

Semantic



- Meaning of location

chaos

American government

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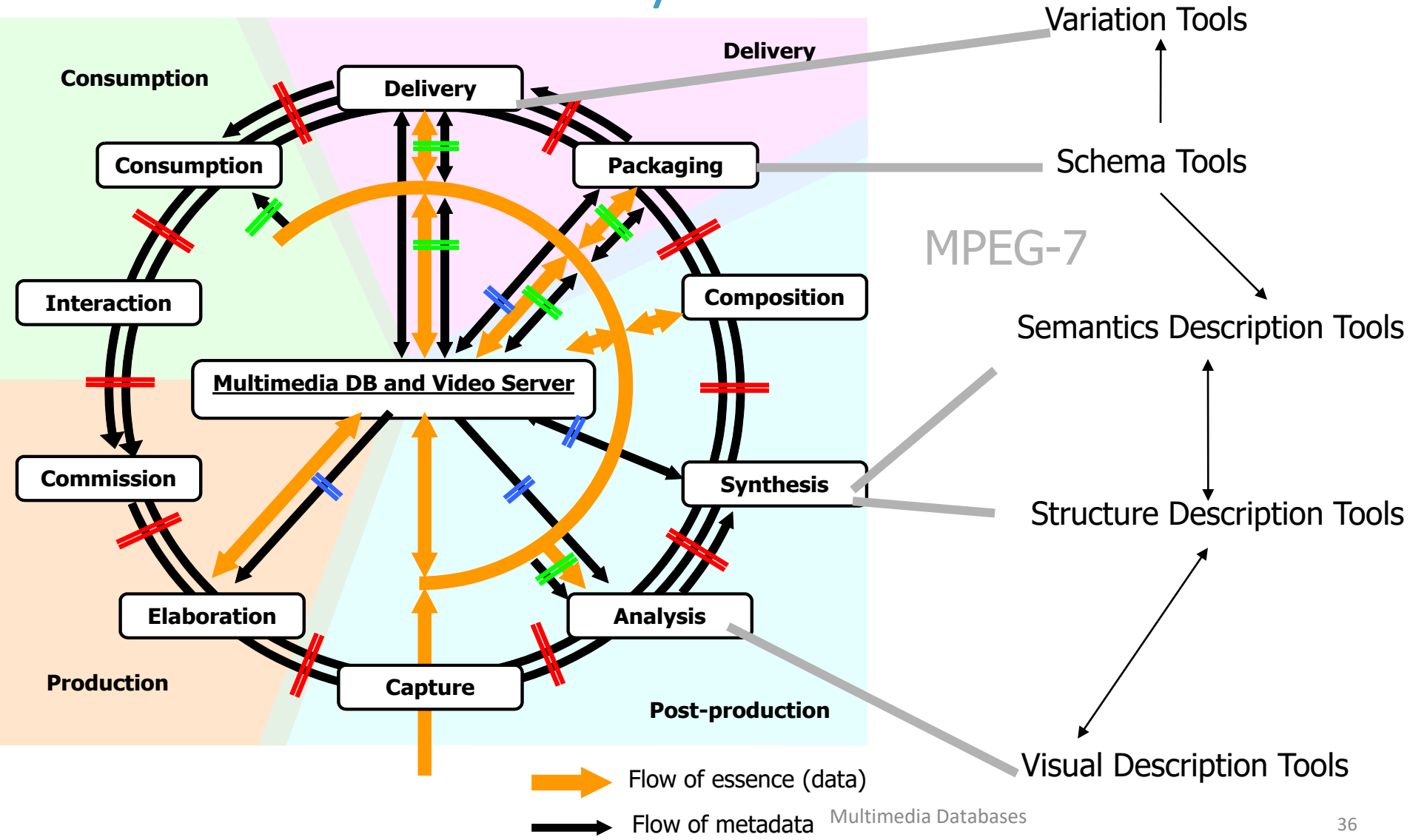
Multimedia Modeling

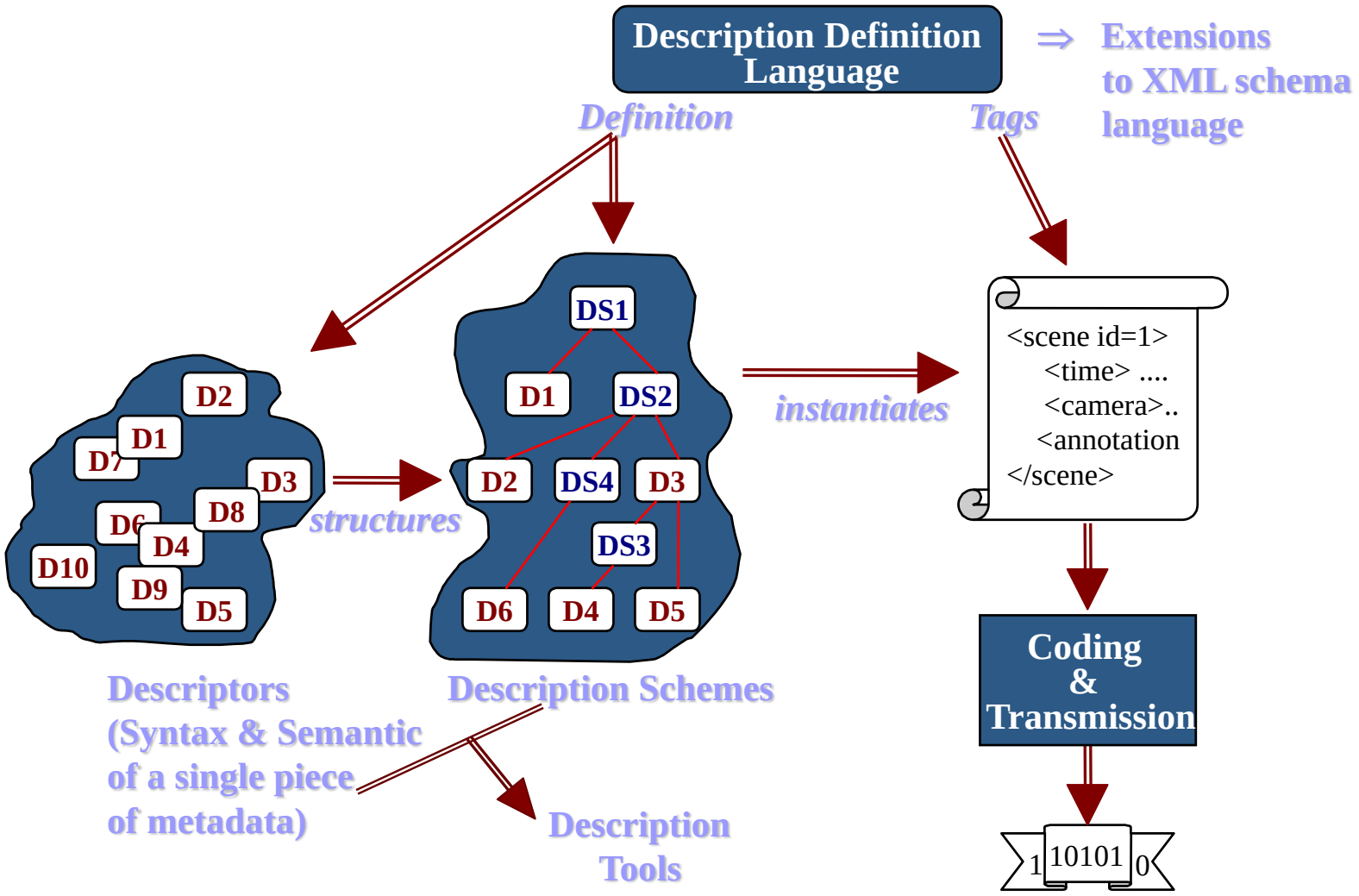
MPEG-7 Standard Parts

- 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 Schemes (MDS)
- ISO / IEC 15938 - 6: Reference Software
- ISO / IEC 15938 - 7: Conformance
- ISO / IEC 15938 - 8: Extraction and Use
- ISO / IEC 15938 - 9: Profile
- ISO / IEC 15938 - 10: Schema Definition
- ISO / IEC 15938 - 11: Profile Schemas
- ISO / IEC 15938 - 12: Query Format

MPEG-7 and the Multimedia Metadata Life Cycle



MPEG-7 Structural Overview



MPEG-7 Data Definition Language (DDL)

- Specifies the syntax of MPEG-7 description tools
- Elements of the DDL:
  - Standard XML-Schema constructs:
    - Declaration of namespaces, elements, attributes and types
    - Structural properties: order and number of child elements
    - Default, max/min values for attributes
  - MPEG-7 specific extensions:
    - Array and matrix data types, temporal data types (e.g. timePoint)

Basic Description Tools
Multimedia Description Schemes

- All Descriptors that can apply to any media object:
  - Content Creation: title, creator, classification
  - Usage: rights, usage statistics
  - Content variations
  - Organization of items in collections
  - Information on content summaries
  - …

Basic Descriptors

Low-level Descriptors Example: MPEG-7 Visual (1)

- Basic structures (5 D's)
  - Grid layout
  - Time series
  - Multiple view
  - Spatial 2D co-ordinates
  - Temporal interpolation

- Color (7 D's)
  - Color Space & Color Quantization
  - Scalable Color: HSV color space & Haar transformation
  - Dominant Color
  - Color Layout, Color structure
  - Group-of-Frames/Group-of-Pictures color

Basic Descriptors

Low-level Descriptors Example: MPEG-7 Visual (2)

- Texture (3 D's)
  - Homogenous: directionality, coarseness and regularity of patterns
  - Non-Homogenous (Edge Histogram)
- Shape (3 D's)
  - Contour-based: Curvature Scale-Space (CCS)
  - Region-based: Angular Radial Transformation
  - 3D

- Motion (4 D's)
  - Motion Activity: intensity, direction, spatial distribution
  - Camera Motion
  - Motion Trajectory
- Localization (2 D's)
  - Region locator
  - Spatial-temporal locator
- Face recognition (1D)

Structure of MPEG-7 Descriptions:

The Root Element is the starting point

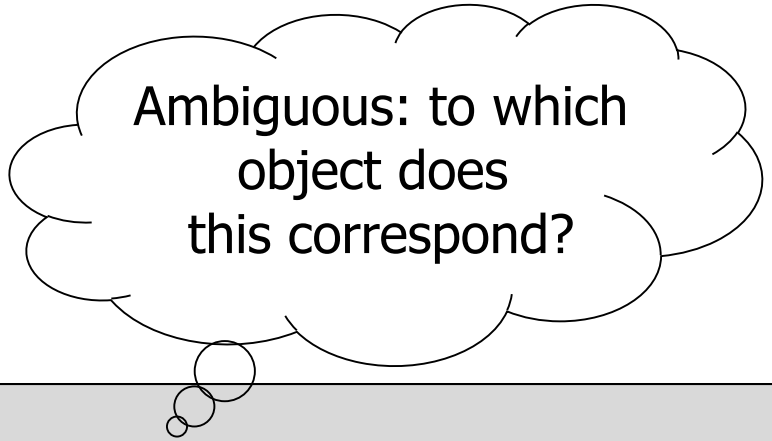
- The root element shall be used as the topmost element of an MPEG-7 description.
- First choice to make:
  - Complete Description: describes multimedia content using one of the top-level types. For example, the description of an image is a complete description.
  - Description Unit: describes an instance of a D, DS, or header. A description unit can be used to represent partial information from a complete description. For example, the description of a shape or color is a description unit.

Definition of the MPEG-7 Root Element

```
<!-- Definition of Mpeg7 Element -->
<element name="Mpeg7">
   <complexType>
      <complexContent>
         <extension base="mpeg7:Mpeg7Type">
            <choice>
               <element name="DescriptionUnit"
                        type="mpeg7:Mpeg7BaseType"/>
               <element name="Description"
                        type="mpeg7:CompleteDescriptionType"
                  minOccurs="1" maxOccurs="unbounded"/>
            </choice>
         </extension>
      </complexContent>
   </complexType>
</element>
```

Description Unit

An example



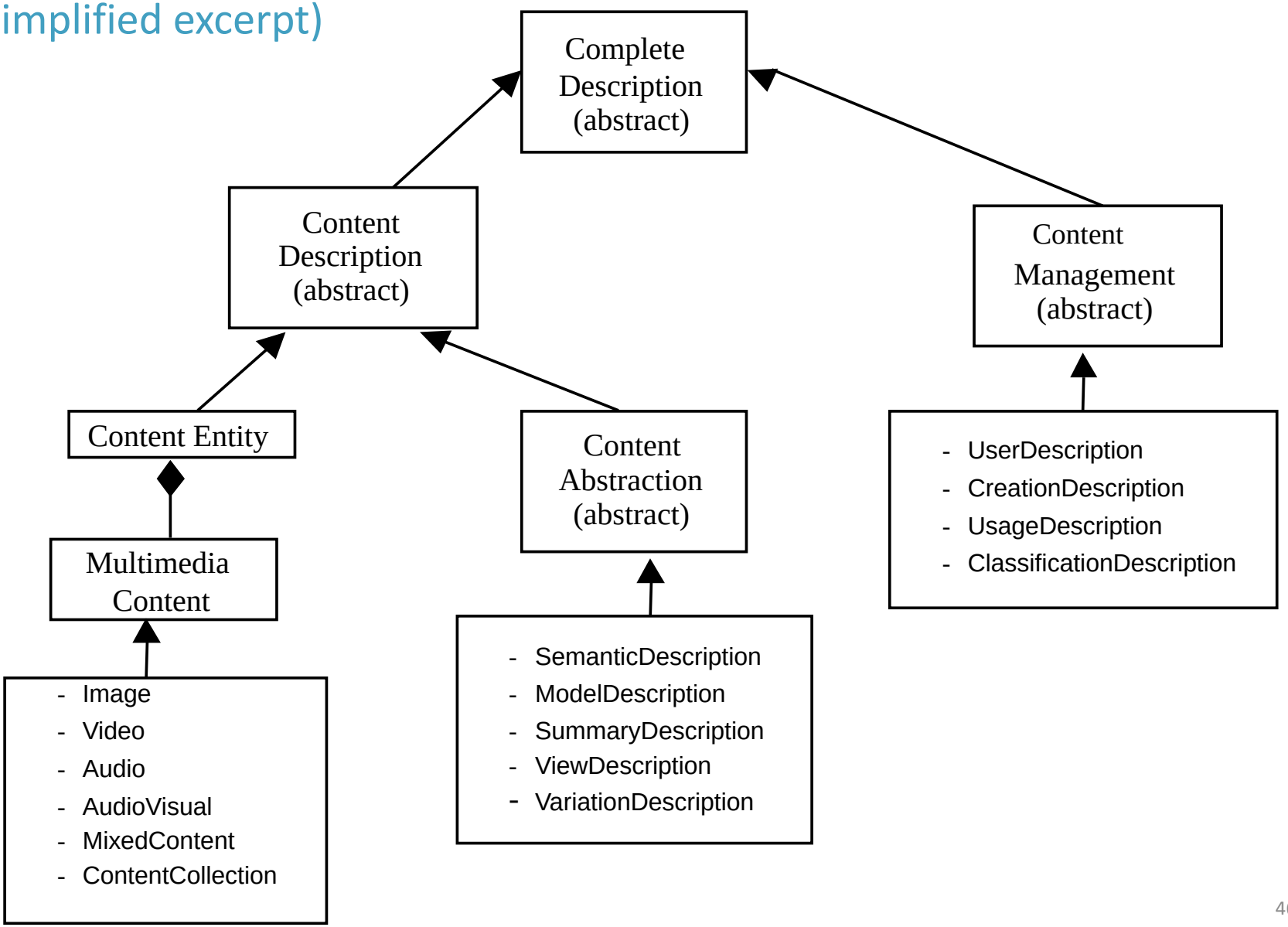

```
<Mpeg7>
    <DescriptionMetadata>
        <Version>1.0</Version>
        <PrivateIdentifier>descriptionUnitExample</PrivateIdentifier>
    </DescriptionMetadata>
    <DescriptionUnit xsi:type="ScalableColorType" numOfCoeff="16"
        numOfBitplanesDiscarded="0">
        <Coeff> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 </Coeff>
    </DescriptionUnit>
</Mpeg7>
```

Choice of the MPEG-7 Top-Level Type

- MPEG-7 specifies a number of top-level types.
- A top-level-type corresponds to a particular description task: describing an image, a video, the usage of an object, variations of multimedia content, etc.
- The top-level types form a hierarchy glued together by the CompleteDescription type

Top-Level Types Hierarchy

(simplified excerpt)



MultimediaContent(Type) (1)

```
<!-- Definition of Image Content Entity -->
<complexType name="ImageType">
   <complexContent>
      <extension base="mpeg7:MultimediaContentType">
         <sequence>
            <element name="Image" type="mpeg7:StillRegionType"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>

<!-- Definition of Video Content Entity -->
<complexType name="VideoType">
   <complexContent>
      <extension base="mpeg7:MultimediaContentType">
         <sequence>
            <element name="Video" type="mpeg7:VideoSegmentType"/>
         </sequence>
      </extension>
   </complexContent>
</complexType>
…
```

MultimediaContent(Type) Example

```
<Mpeg7>
  <Description xsi:type="ContentEntityType">
         <MultimediaContent xsi:type="VideoType">
            <Video>
                  <CreationInformation>
                     <Creation>
                           <Title> Worldcup Soccer </Title>
                     </Creation>
                  </CreationInformation>
                  <MediaTime>
                     <MediaTimePoint>T00:00:00</MediaTimePoint>
                     <MediaDuration>PT1M30S</MediaDuration>
                  </MediaTime>
                  <VisualDescriptor xsi:type="GoFGoPColorType"
                  aggregation="Average">
                     <ScalableColor numOfCoeff="16"
                      numOfBitplanesDiscarded="0">
                               <Coeff> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 </Coeff>
                     </ScalableColor>
                  </VisualDescriptor>
             </Video>
         </MultimediaContent>
    </Description>
</Mpeg7>
```

Composition of Multimedia Content

Mixed content

Decomposition of mixed content

The element has the type VideoSegment rather than video

```
<Mpeg7>
   <Description xsi:type="ContentEntityType">
      <MultimediaContent xsi:type="MultimediaType">
         <Multimedia>
            <MediaSourceDecomposition gap="false" overlap="false">
               <Segment xsi:type="StillRegionType">
                  <TextAnnotation>
                     <FreeTextAnnotation> image </FreeTextAnnotation>
                  </TextAnnotation>
               </Segment>
               <Segment xsi:type="VideoSegmentType">
                  <TextAnnotation>
                     <FreeTextAnnotation> video </FreeTextAnnotation>
                  </TextAnnotation>
                  <MediaTime>
                     <MediaTimePoint>T00:00:00</MediaTimePoint>
                     <MediaDuration>PT0M15S</MediaDuration>
                  </MediaTime>
               </Segment>
               <Segment xsi:type="AudioSegmentType">
                  <TextAnnotation>
                     <FreeTextAnnotation> audio </FreeTextAnnotation>
                  </TextAnnotation>
               </Segment>
            </MediaSourceDecomposition>
..
```

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Multimedia Modeling

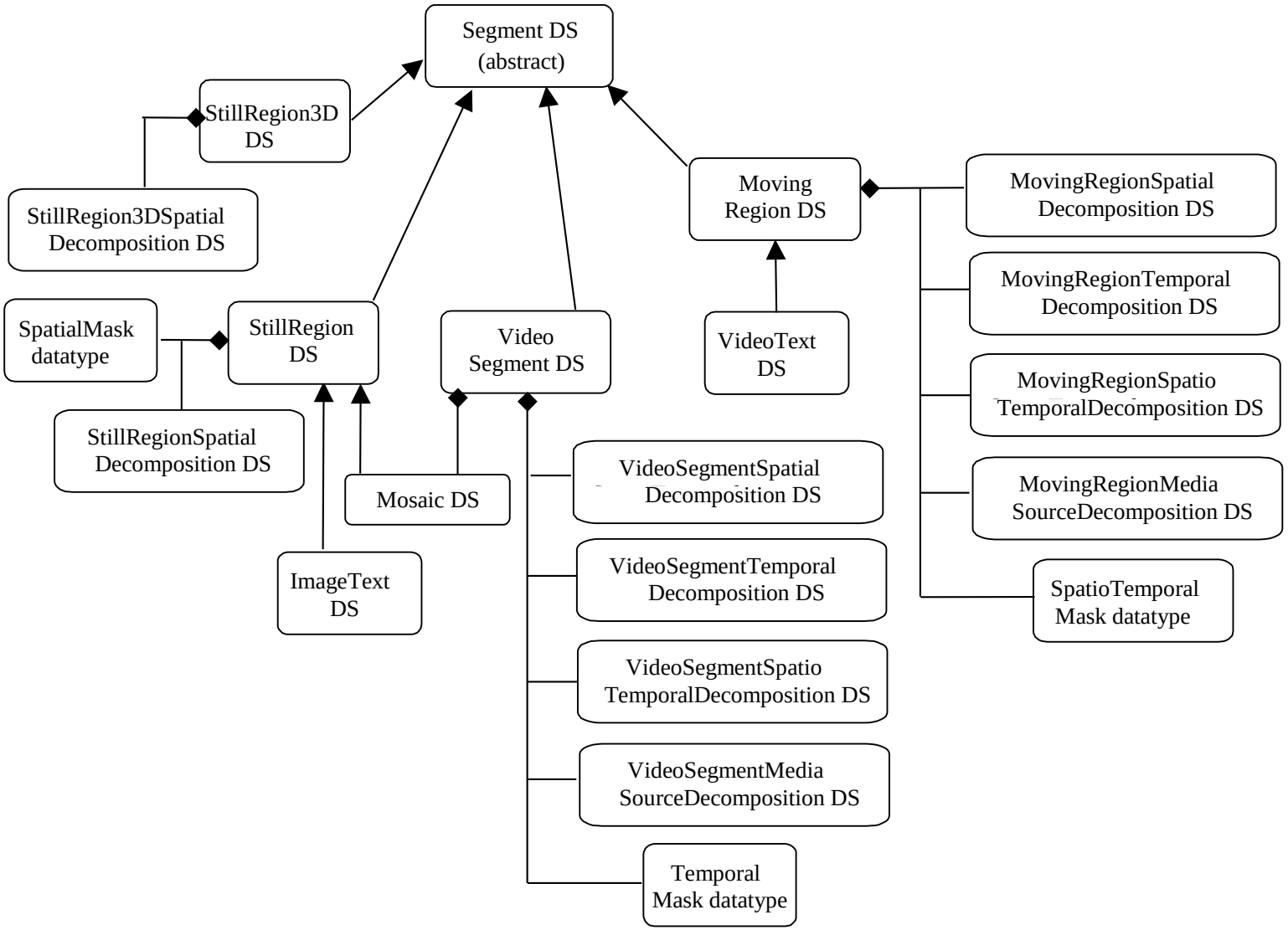
The MultimediaContent type is used for structural description

- Use of structure description tools

- The structure description tools enable:
  - Spatial,
  - Temporal,
  - Spatio-temporal
  - Or media-type based segmentation

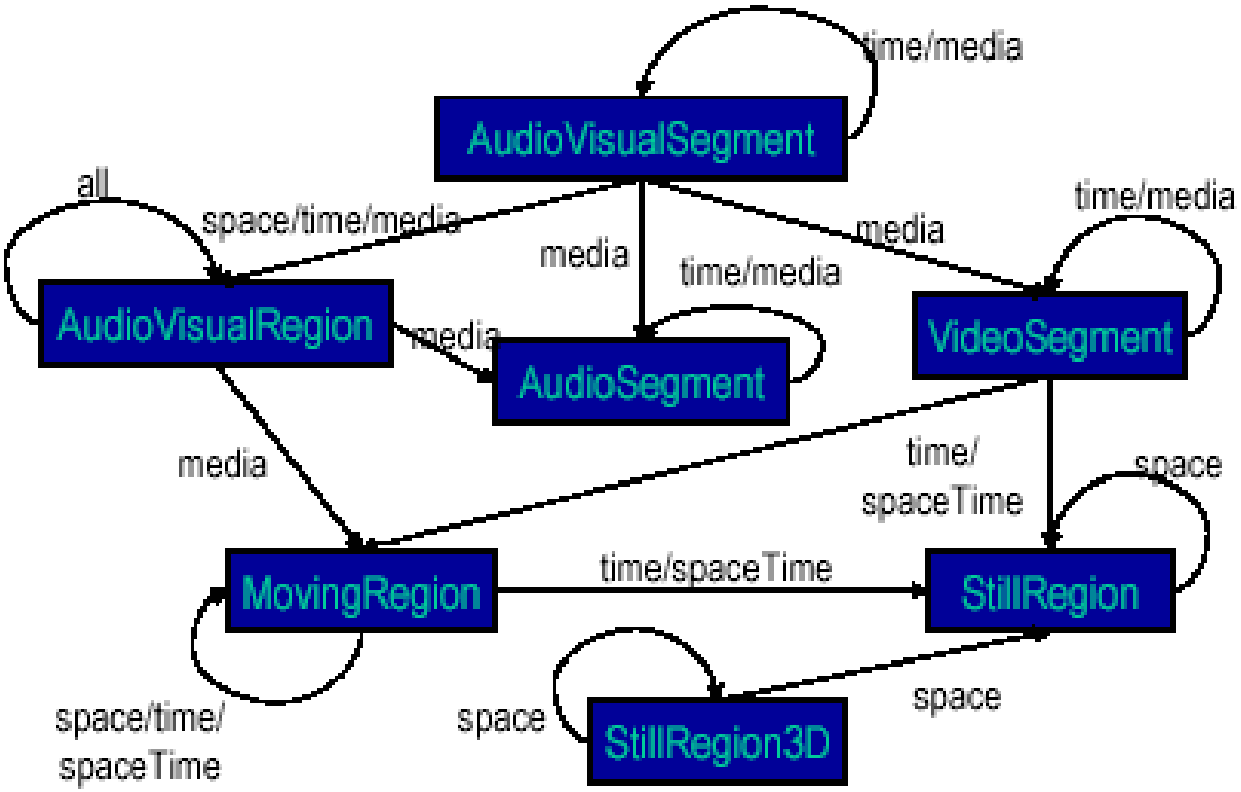
  - Root element = SegmentType

SegmentType = Segment DS



Segment Composition

- Relationships between segment types



- **Spatial** (image decomposition into regions)
- **Temporal** (video decomposition into segments)
- **Spatio-temporal** (video decomposition into moving regions)
- **Media** (video decomposition into audio and video tracks)

Illustration of segment composition I

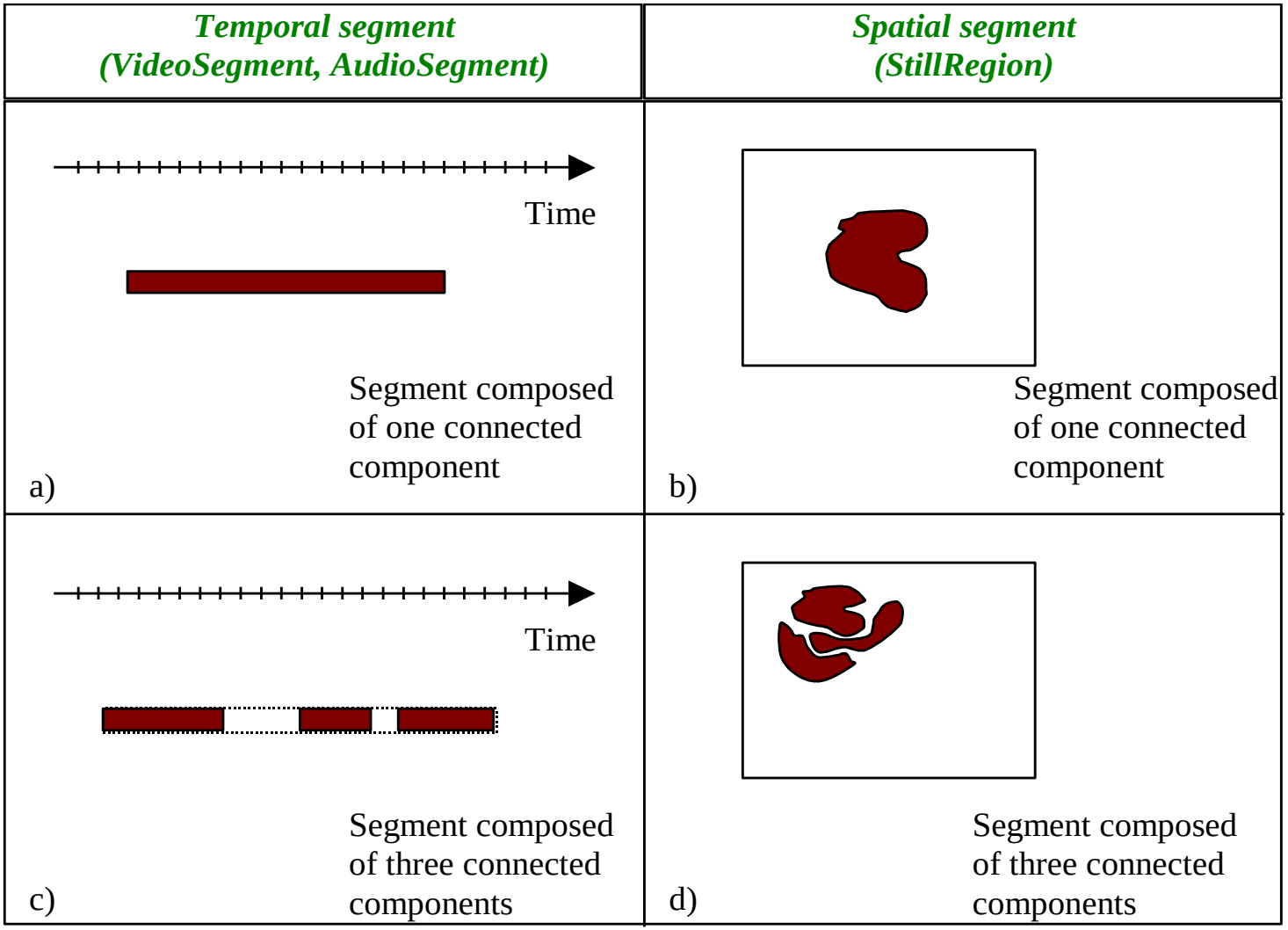
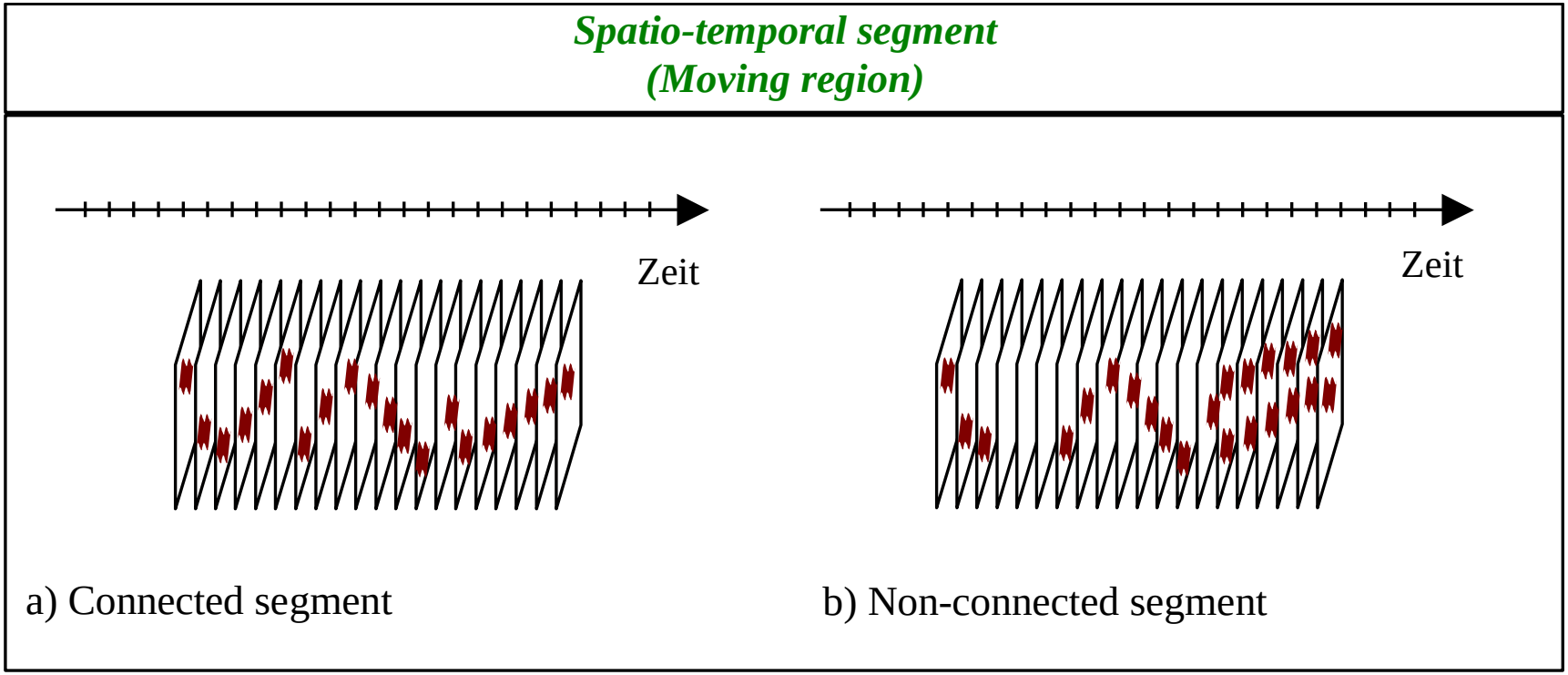
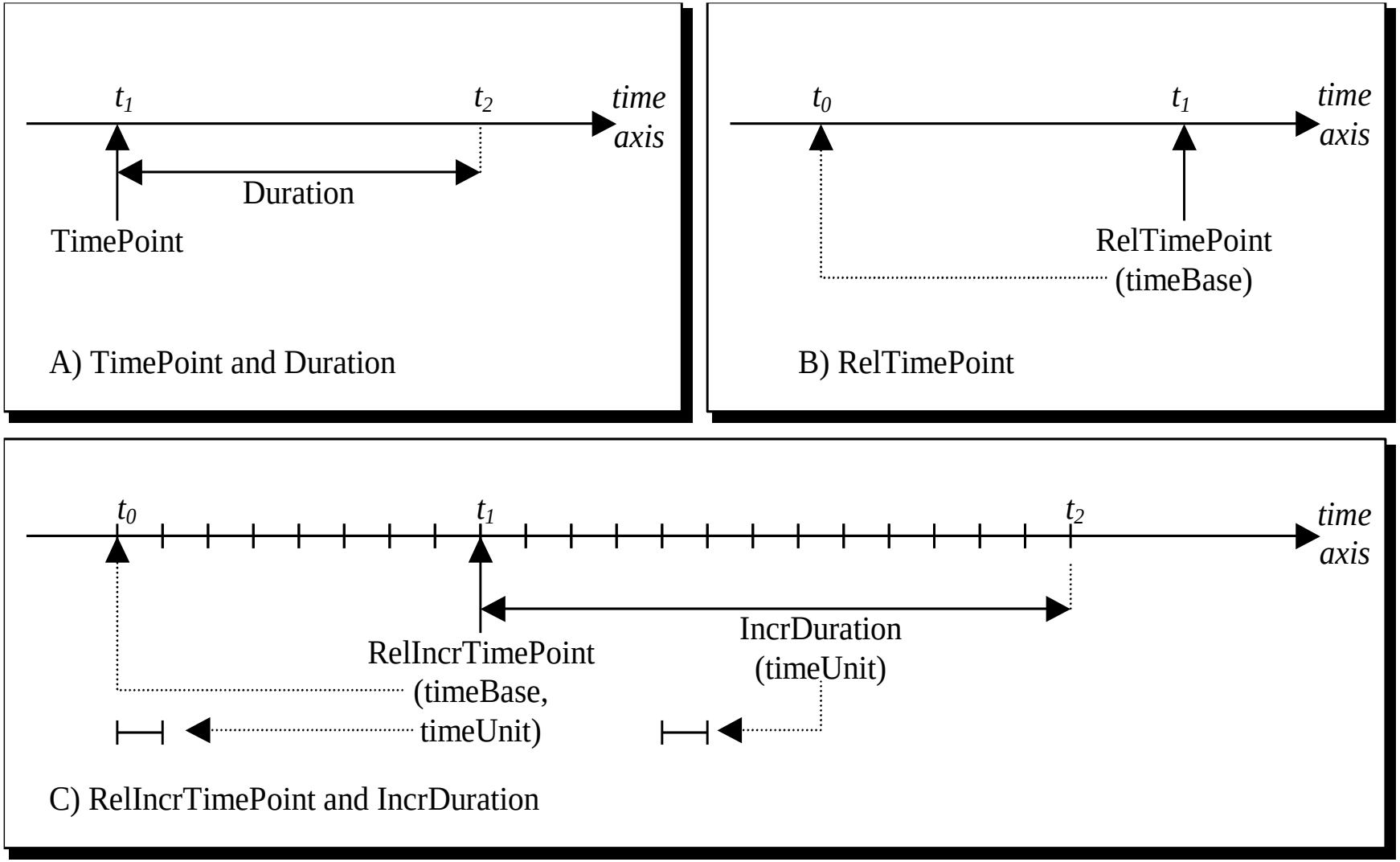


Illustration of segment composition II



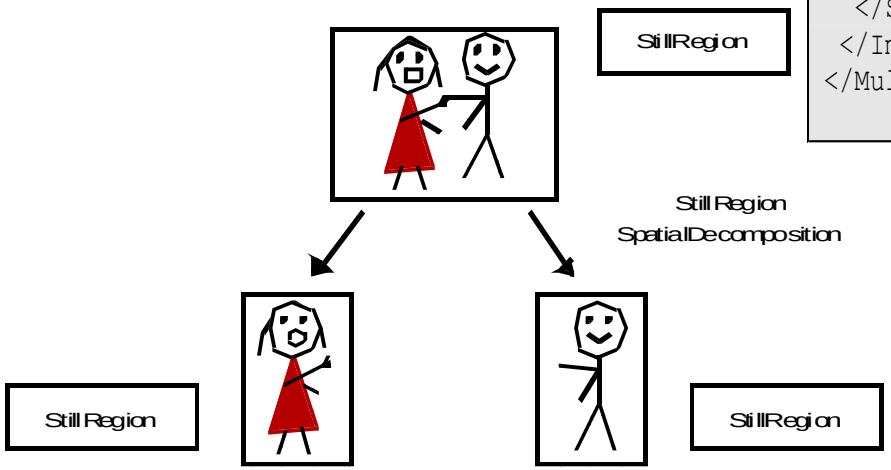
Temporal segmentation needs time-related information



Examples
Image Description

- Content management metadata:
  - Media information
  - Creation & production;
  - usage
- Visual features:
  - Visual descriptors
- Structure:
  - Regions, spatial decomp.
  - spatio-temporal relations

```
<MultimediaContent xsi:type="ImageType">
 <Image>
  <SpatialDecomposition gap="true" overlap="false">
    <StillRegion id="AlexSR">
     <VisualDescriptor xsi:type="ScalableColorType" numOfCoeff="16"
                  numOfBitplanesDiscarded="0">
        <Coeff> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 </Coeff>
    </VisualDescriptor>
   </StillRegion>
   <StillRegion id="AnaSR">
     <VisualDescriptor xsi:type="ScalableColorType" numOfCoeff="16"
                  numOfBitplanesDiscarded="0">
        <Coeff> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 </Coeff>
     </VisualDescriptor>
    </StillRegion>
  </SpatialDecomposition>
 </Image>
</MultimediaContent>
```



Description of Spatial Properties

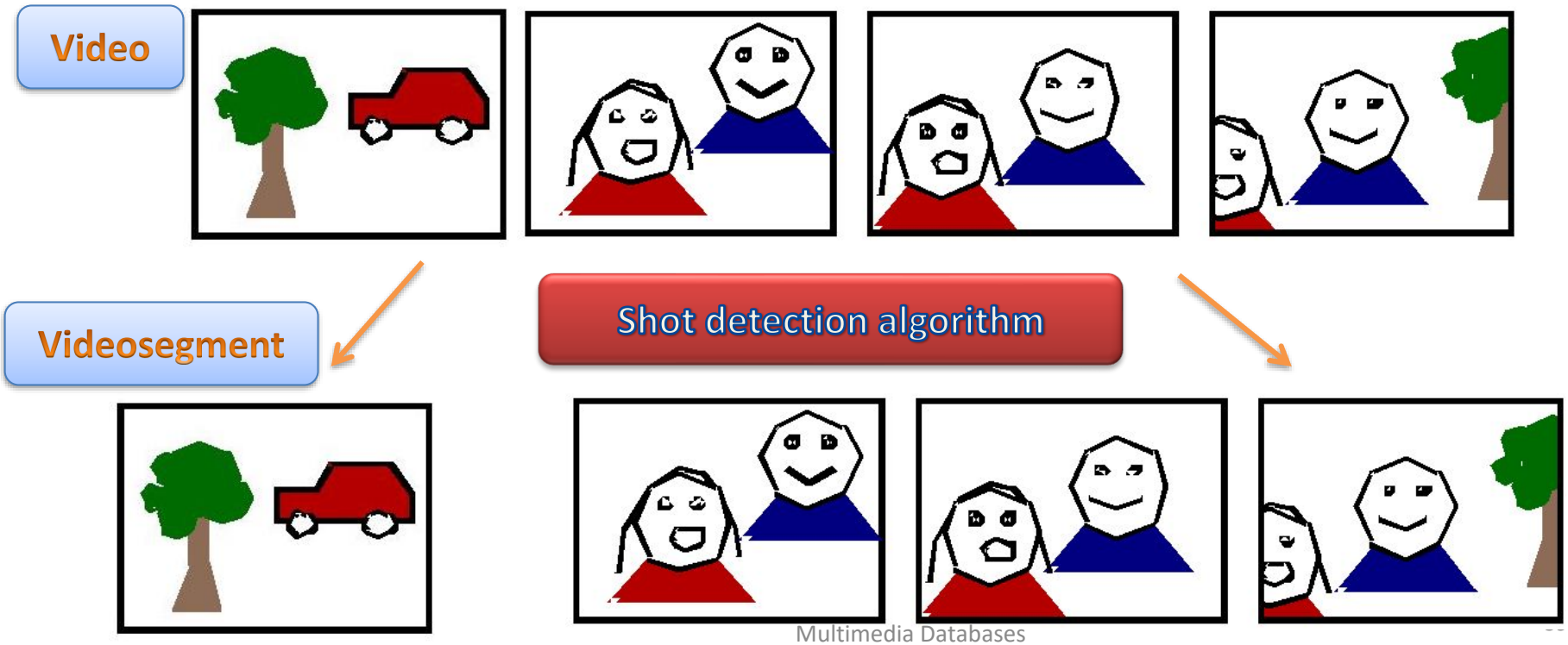
- Use of a SpatialMask in the StillRegionType

```
<SpatialMask>
   <SubRegion>
      <Polygon>
         <Coords mpeg7:dim="2 5"> 5 25 10 20 15 15 10 10 5 15 </Coords>
      </Polygon>
   </SubRegion>
   <SubRegion>
      <Polygon>
         <Coords mpeg7:dim="2 6"> 7 24 15 24 20 27 18 25 15 22 7 22 </Coords>
      </Polygon>
   </SubRegion>
   <SubRegion>
      <Polygon>
         <Coords mpeg7:dim="2 4"> 7 30 15 30 15 25 7 25</Coords>
      </Polygon>
   </SubRegion>
</SpatialMask>
```

Examples
Video Description

- Video attributes
  - CreationInformation
  - MediaInformation
  - UsageInformation
  - Semantics

- Segment attributes
  - MediaTime
  - MotionActivity
  - VisualDescriptor



VideoSegment of the example

```
<MultimediaContent xsi:type="VideoType">
   <Video id="RootVS">
      <MediaTime>
        <MediaTimePoint>T00:00:00</MediaTimePoint>
        <MediaDuration>PT1M30S</MediaDuration>
      </MediaTime>
      <VisualDescriptor xsi:type="GoFGoPColorType"
                    aggregation="Average">
         <ScalableColor numOfCoeff="16"
                    numOfBitplanesDiscarded="0">
          <Coeff> 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 </Coeff>
         </ScalableColor>
      </VisualDescriptor>
      <TemporalDecomposition gap="false" overlap="false">
         <VideoSegment id="ChaseVS">
            <TextAnnotation>
             <FreeTextAnnotation> Chase</FreeTextAnnotation>
            </TextAnnotation>
            <MediaTime>
               <MediaTimePoint>T00:00:00</MediaTimePoint>
               <MediaDuration>PT0M15S</MediaDuration>
            </MediaTime>
            <VisualDescriptor xsi:type="GoFGoPColorType"
                  aggregation="Average">
               <ScalableColor numOfCoeff="16"
                           numOfBitplanesDiscarded="0">
                  <Coeff> 1 2 3 4 5 6 7 8 9 0 </Coeff>
               </ScalableColor>
            </VisualDescriptor>
         </VideoSegment>
...
```

Time info for whole video

Temporal decomposition

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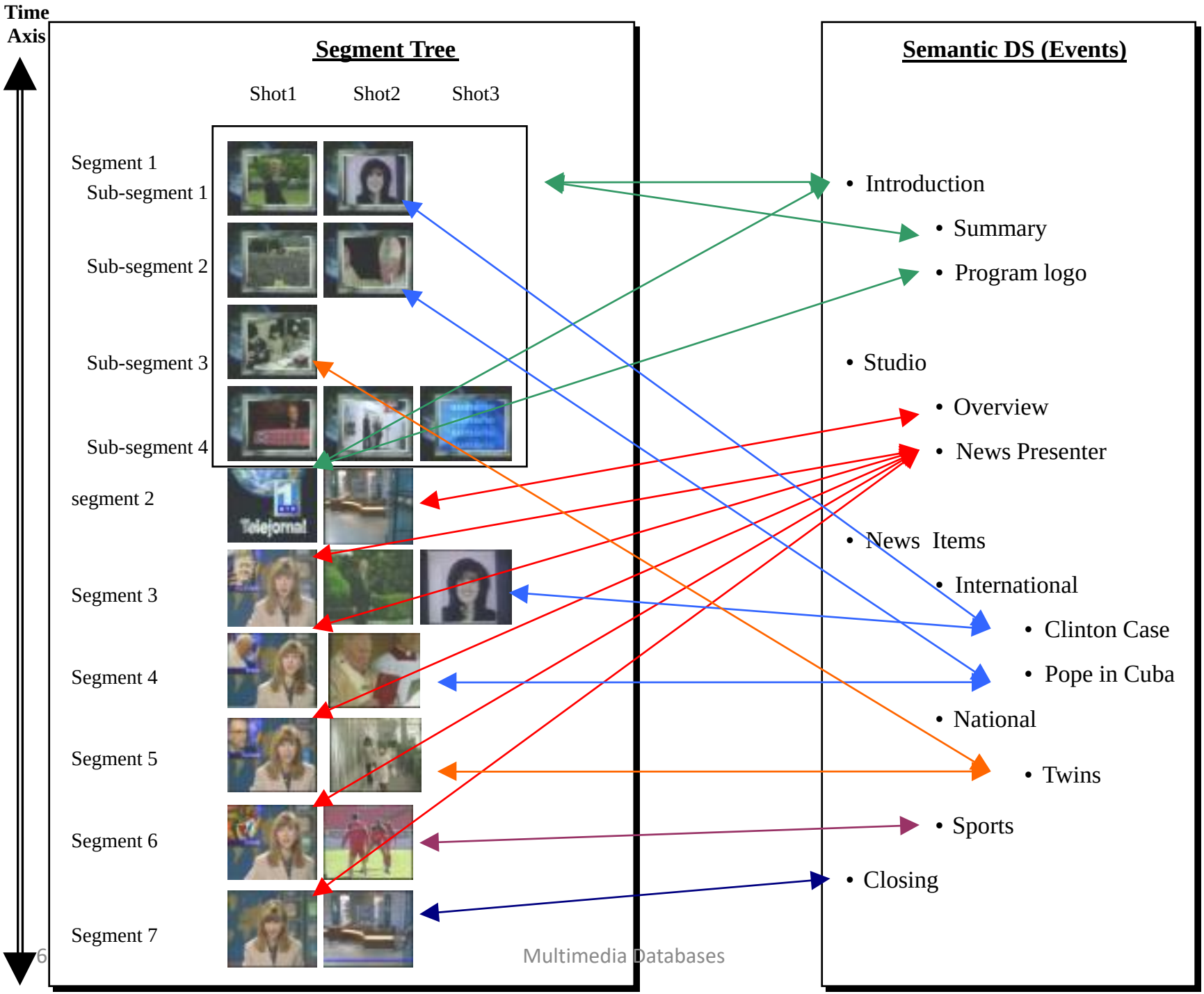
Multimedia Modeling

From Segment to Semantics

- Use of the Semantic Element in SegmentType

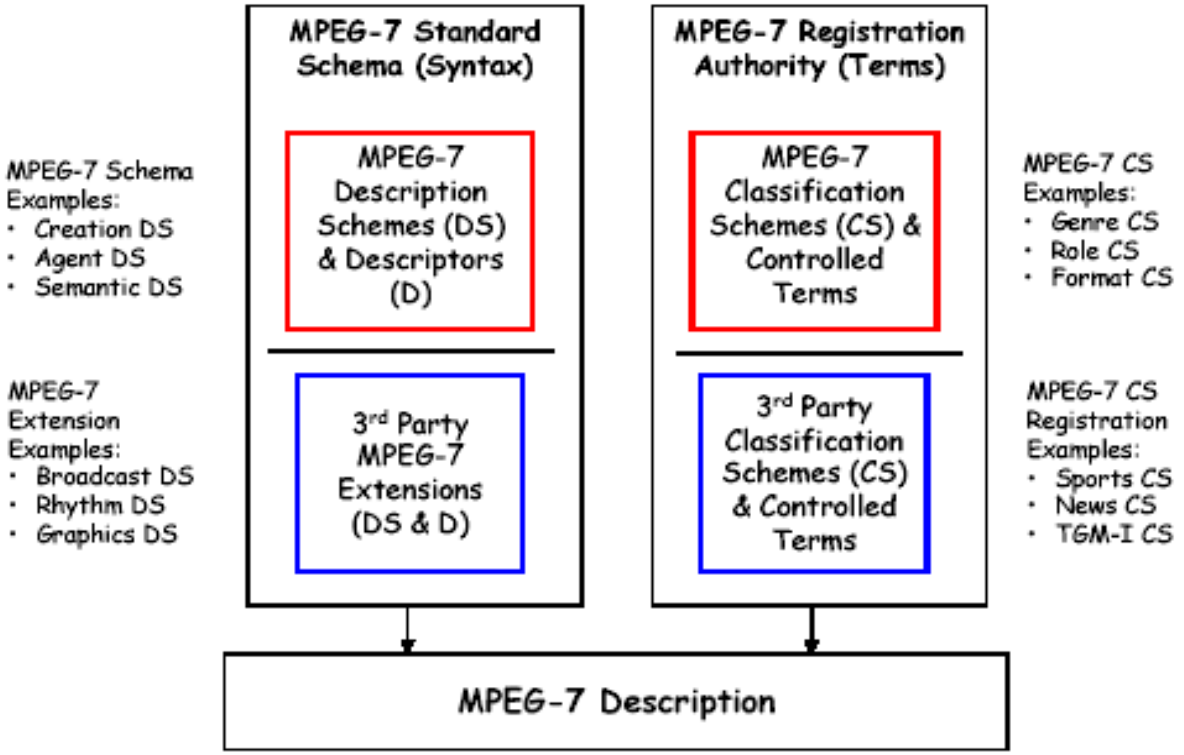
```
<choice minOccurs="0" maxOccurs="unbounded">
      <element name="Semantic" type="mpeg7:SemanticType"/>
      <element name="SemanticRef" type="mpeg7:ReferenceType"/>
</choice>
```

- Can be used in all segment types (in particular Audio- and VideoSegment)
- The semantics can be directly embedded, or embedded through the reference mechanism


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

Classification Schemes (CS)

- Integration of taxonomies
- Consistent naming for persons, objects, etc.

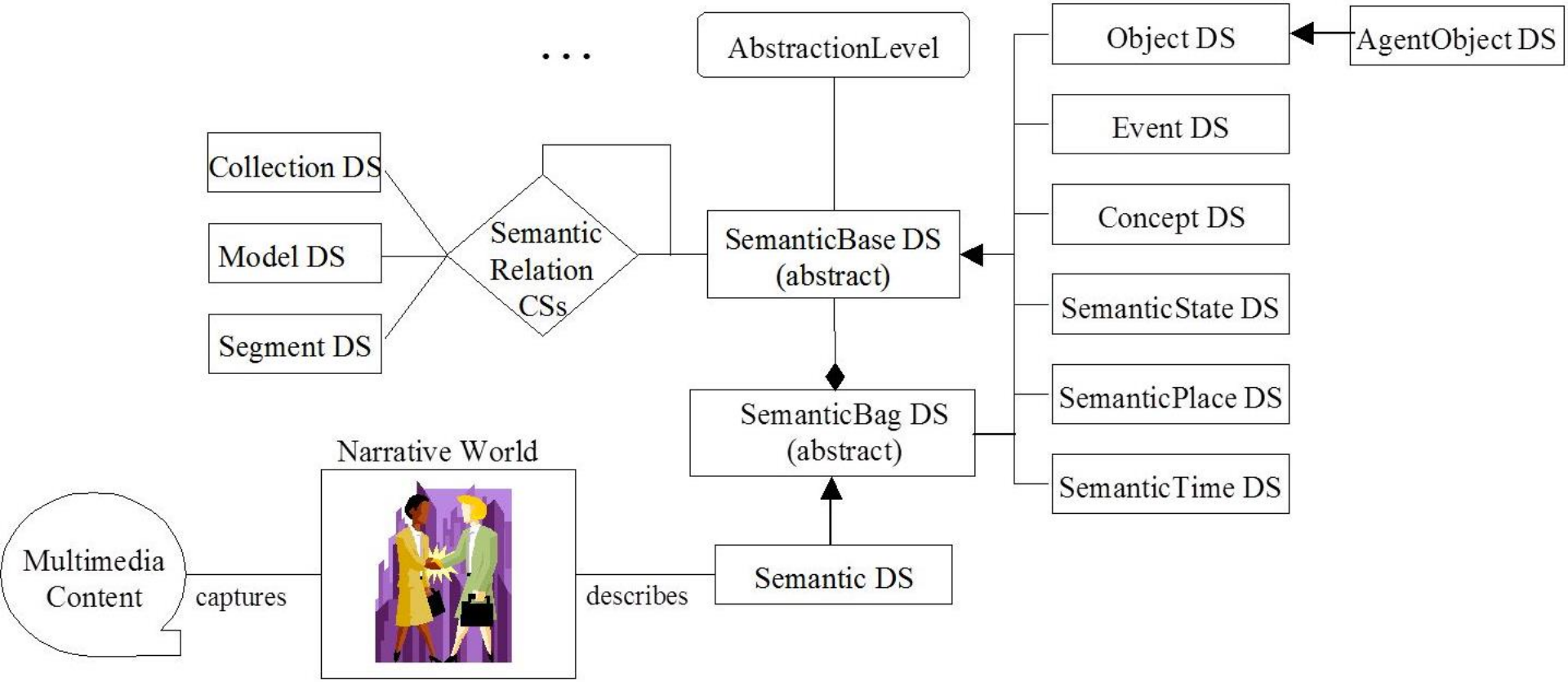


CS-Example: FileFormatCS

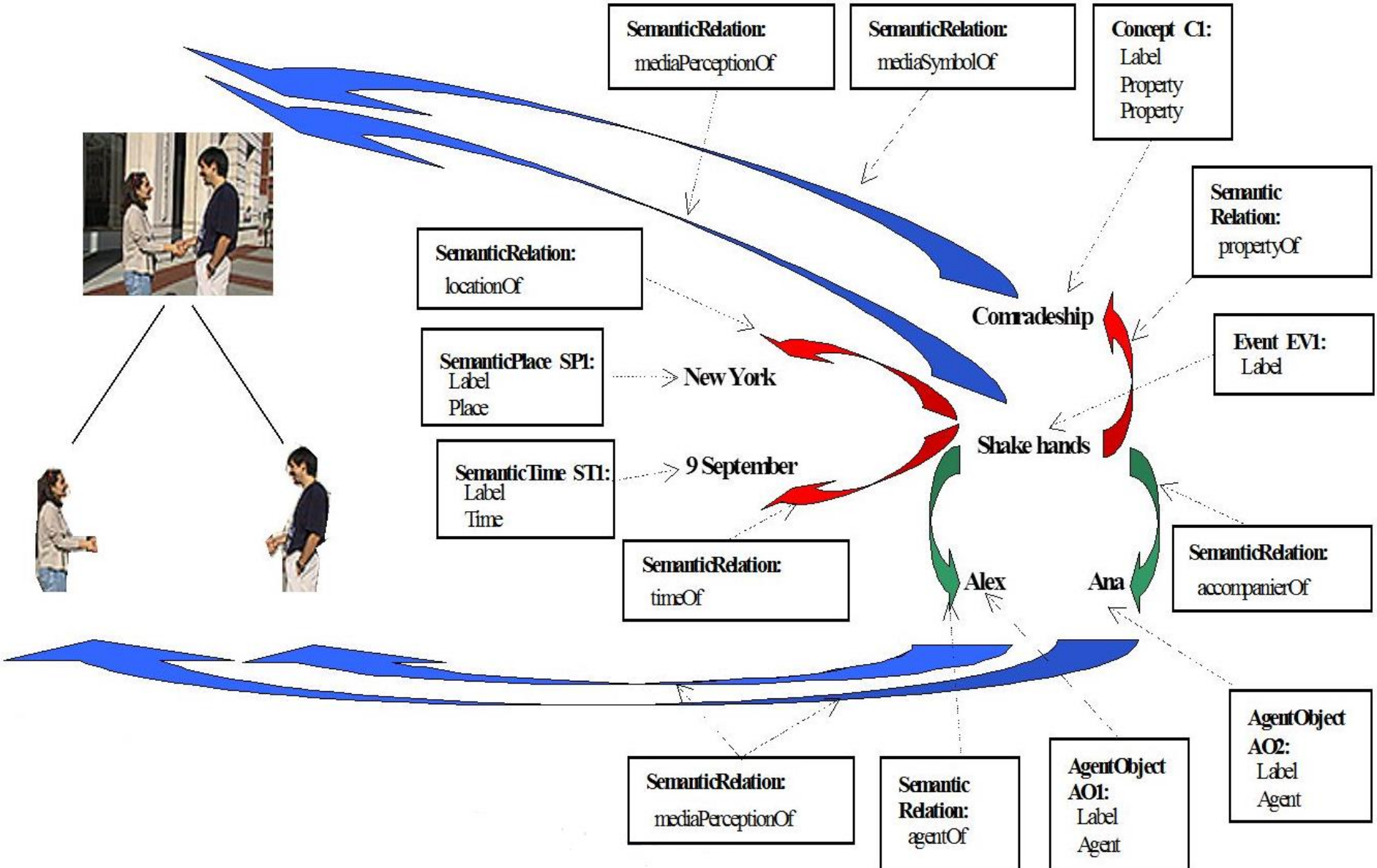
```
<ClassificationScheme uri="urn:mpeg:mpeg7:cs:FileFormatCS:2001"
   domain="//MediaInformation/MediaProfile/MediaFormat/FileForm
at">
   <Term termID="1">
      <Name xml:lang="en">jpeg</Name>
      <Name xml:lang="en">jpg</Name>
      <Name xml:lang="en">jfif</Name>
      <Definition xml:lang="en">JPEG file format</Definition>
   </Term>
   <Term termID="2">
      <Name xml:lang="en">JPEG 2000</Name>
      <Definition       xml:lang="en">JPEG       2000       file
format</Definition>

 … other terms …
</ClassificationScheme>
```

CS for parental rating, genre, quality, etc.
New CS must be registered by MPEG-7 org.

SemanticsType



Example of Semantics Description



AgentObject

- An AgentObject is a person, group of person or organization.

```
<Mpeg7>
   <Description xsi:type="SemanticDescriptionType">
      <Semantics>
         <Label>
            <Name> Description of person </Name>
         </Label>
         <SemanticBase xsi:type="AgentObjectType">
            <Label>
               <Name> Student </Name>
            </Label>
            <Definition>
               <FreeTextAnnotation> Student named Alexander Green
               </FreeTextAnnotation>
            </Definition>
            <Agent xsi:type="PersonType">
               <Name>
                  <GivenName abbrev="Alex"> Alexander </GivenName>
                  <FamilyName> Green </FamilyName>
               </Name>
            </Agent>
         </SemanticBase>
      </Semantics>
   </Description>
</Mpeg7>
```

Event

- Let's shake hands!

Semantic Relation

```
<Mpeg7>
   <Description xsi:type="SemanticDescriptionType">
      <Semantics>
         <Label>
            <Name> Shake hands </Name>
         </Label>
         <SemanticBase xsi:type="AgentObjectType" id="AOa">
            <Label href="urn:example:acs">
               <Name> Person A </Name>
            </Label>
         </SemanticBase>
         <SemanticBase xsi:type="AgentObjectType" id="AOb">
            <Label href="urn:example:acs">
               <Name> Person B </Name>
            </Label>
         </SemanticBase>
         <SemanticBase xsi:type="EventType" id="EV1">
            <Label href="urn:example:acs">
               <Name> Shake hands </Name>
            </Label>
            <Definition>
               <FreeTextAnnotation>
                  Clasping of right hands by two people.
               </FreeTextAnnotation>
            </Definition>
            <Relation
               type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:agent"
               target="#AOa"/>
            <Relation
              type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:accompanier"
               target="#AOb"/>
         </SemanticBase>
      </Semantics>
   </Description>
</Mpeg7>
```

Semantic Relations are CS

- The SemanticRelation CS defines semantic relations. The semantic relations describe semantic information that relates entities such as the relationship of events in a narrative, or relationship of an object to multimedia content that depicts the object.

```
<ClassificationScheme uri="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001">
   <Header xsi:type="DescriptionMetadataType">
      <Comment>
         <FreeTextAnnotation xml:lang="en">
            Semantic relations
         </FreeTextAnnotation>
      </Comment>
   </Header>
   <Term termID="key">
      <Definition>
         A key B if and only if B is a key for accessing A.
      </Definition>
   </Term>
   <Term termID="keyFor">
      <Definition> Inverse relation of key </Definition>
   </Term>
   <Term termID="annotates">
      <Definition>
         A annotates B if and only if A is an annotation or description
of B.
      </Definition>
   </Term>
```

SemanticPlace

- Describes the location of the event in this *Narrative World*: „Columbia University“

```
<Mpeg7>
   <Description xsi:type="SemanticDescriptionType">
      <Semantics>
         <Label>
            <Name> Semantic place for Columbia University </Name>
         </Label>
         <SemanticBase xsi:type="SemanticPlaceType" id="columbia-
                                          location">
            <Label>
               <Name> Columbia University </Name>
            </Label>
            <Place>
               <Name xml:lang="en">
                  Columbia University in the City of New York </Name>
               <Region> us </Region>
               <PostalAddress>
                  <AddressLine>  600 West 116th Street, New York,
                                 NY</AddressLine>
                  <PostingIdentifier> U-10027 </PostingIdentifier>
               </PostalAddress>
            </Place>
         </SemanticBase>
      </Semantics>
   </Description>
</Mpeg7>
```

SemanticTime

- Describes the time frame of a scene of the narrative world (numerically or textually)

```
<Mpeg7>
   <Description xsi:type="SemanticDescriptionType">
      <Semantics>
         <Label>
            <Name> Description of last year </Name>
         </Label>
         <SemanticBase xsi:type="SemanticTimeType">
            <Label>
               <Name> Last year </Name>
            </Label>
            <SemanticTimeInterval>
               <TimePoint origin="now">
                  <Displacement measurementType="length" unit="year"
                        value="1"/>
                  <Direction measurementType="direction" unit="direction"
                     value="before"/>
               </TimePoint>
            </SemanticTimeInterval>
         </SemanticBase>
      </Semantics>
   </Description>
</Mpeg7>
```

Use MPEG-7?

- For the brave:
  - Get the schema: http://standards.iso.org/ittf/PubliclyAvailableStandards/MPEG-7_schema_files/
  - Validate instances using tools such as XMLSpy

- Use MPEG-7 software for specific tasks:
  - **Multimedia metadata community**
    - **http://www.multimedia-metadata.info/**

The end