

A User Preference Model and a Query Language that allow Semantic Retrieval and Filtering of Multimedia Content

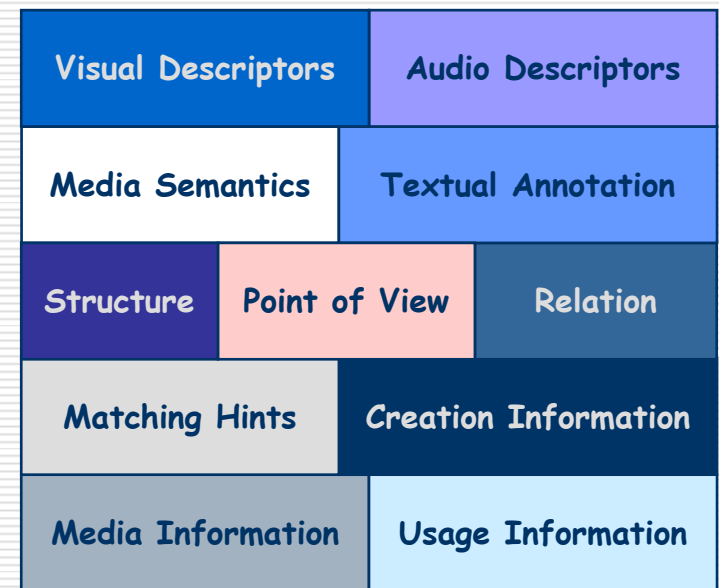
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Motivation

- Open Multimedia Consumption Environment
 - Development of Digital Multimedia Content Services
 - Emergence of Advanced Network Infrastructures
- Standards needed for the Syntactic Interoperation of the Services
- Dominant Standard in Multimedia Content Description: MPEG-7
 - Description of (Segments of) Multimedia Objects



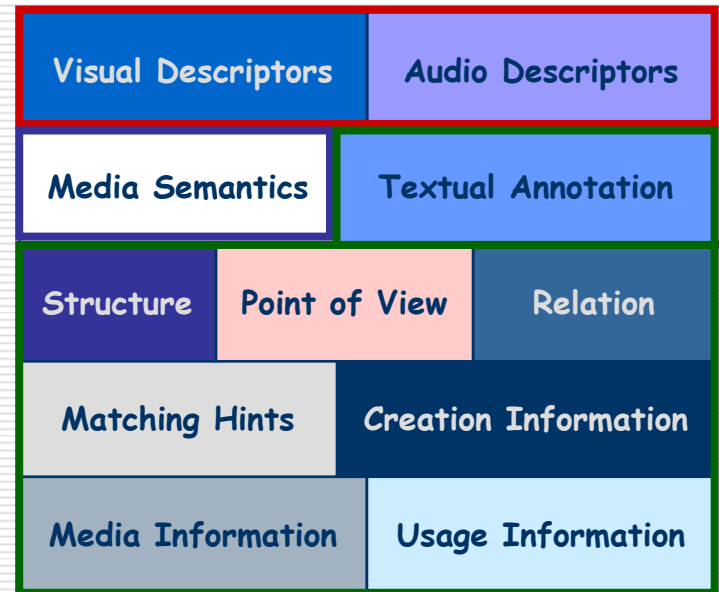
MPEG-7 Description

Motivation

- Semantic Interoperation needed for efficient Retrieval & Filtering Services
 - Integration of Domain Knowledge
- Domain Knowledge
 - Usually expressed as Domain Ontologies
 - Used for:
 - Semantic Retrieval & Filtering
 - Semantically Personalized Services
 - Can be expressed using MPEG-7 constructs [CAiSE03]

Motivation

- Powerful Retrieval can be built on top of MPEG-7 Descriptions
- Several Research Efforts
 - Visual/Audio Descriptors
 - Textual Annotations and/or Media-related Elements
 - Semantic Descriptions
- Treat some aspects only!



MPEG-7 Description

Motivation

- A Uniform and Transparent MPEG-7 Retrieval and Filtering Framework is needed
- Approach 1: Use plain XQuery
 - No Preference Values
 - Partial Exploitation of the MPEG-7 Descriptions
 - Does not take into account the peculiarities of:
 - Visual/Audio Low-level Descriptors
 - Semantic Descriptions
- Approach 2: Use MPEG-7 Filtering and Search Preferences (FASP) as Queries
 - Low-level Descriptors & Semantic Descriptions Absent
 - Not all Media-related Elements Present
 - No Boolean Operators

Motivation

- Response to the Limitations: ISO MPEG-7 Query Format Requirements (MP7QF)
- MP7QL: Response to MP7QF
 - MPEG-7 Query Language
 - Compatible FASP Model
 - Forms a Uniform and Transparent MPEG-7 Retrieval and Filtering Framework
 - Takes into account the MP7QF

Overview

- The MP7QL Query Language
- Filtering and Search Preference Model
- Conclusions
- Future Work

The MP7QL Query Language

- Language for Querying MPEG-7 Descriptions
- MP7QL allows:
 - Uniform and Transparent MPEG-7 Retrieval and Filtering
 - Querying every Aspect of an MPEG-7 Multimedia Object Description
 - Explicit Specification of Boolean Operators and Preference Values
- The MP7QL queries may utilize the User Preferences as Context
 - Allow for Personalized Multimedia Content Retrieval
- The MP7QL Design has taken into account the MP7QF
- Expressed both in XML Schema and OWL
- An implementation of the XML Schema version of MP7QL is under way on top of an XML repository accessed by XQuery

The MP7QL Query Language

- Fundamental MP7QL Element: the MP7QL Query

- Represented by MPEG7QueryType

- MP7QL Queries include:

- Queries about Multimedia Content

Give me the multimedia objects where a goal is scored

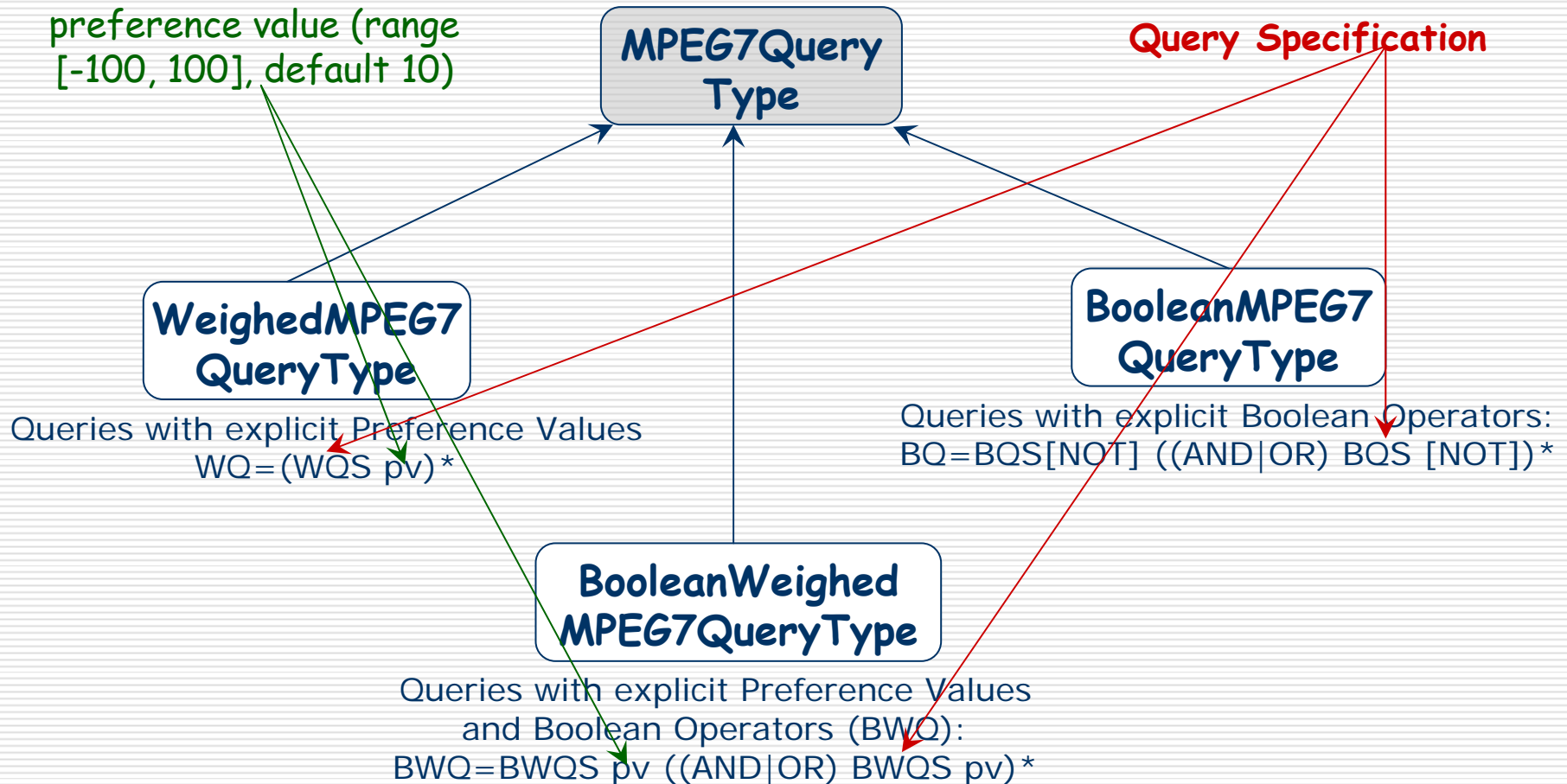
- Queries about Semantic Entities

Give me the players affiliated to the soccer team Barcelona

- Constructs of Domain Ontologies expressed using MPEG-7 Syntax

Give me the subclasses of the Player class

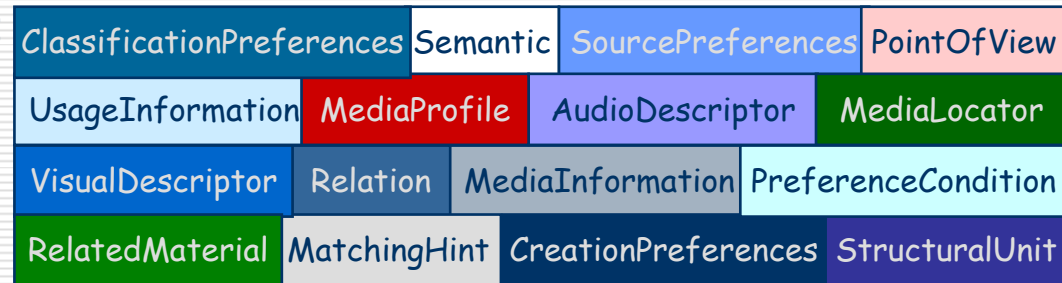
The MP7QL Query Language – Query Types



MP7QL Query Specifications

□ String Comparison Operator:

- "contains" (Default Value)
- "equals"
- "startsWith",
- "endsWith"
- "keywords"



MP7QL Query Specification Elements

□ Number Comparison Operator:

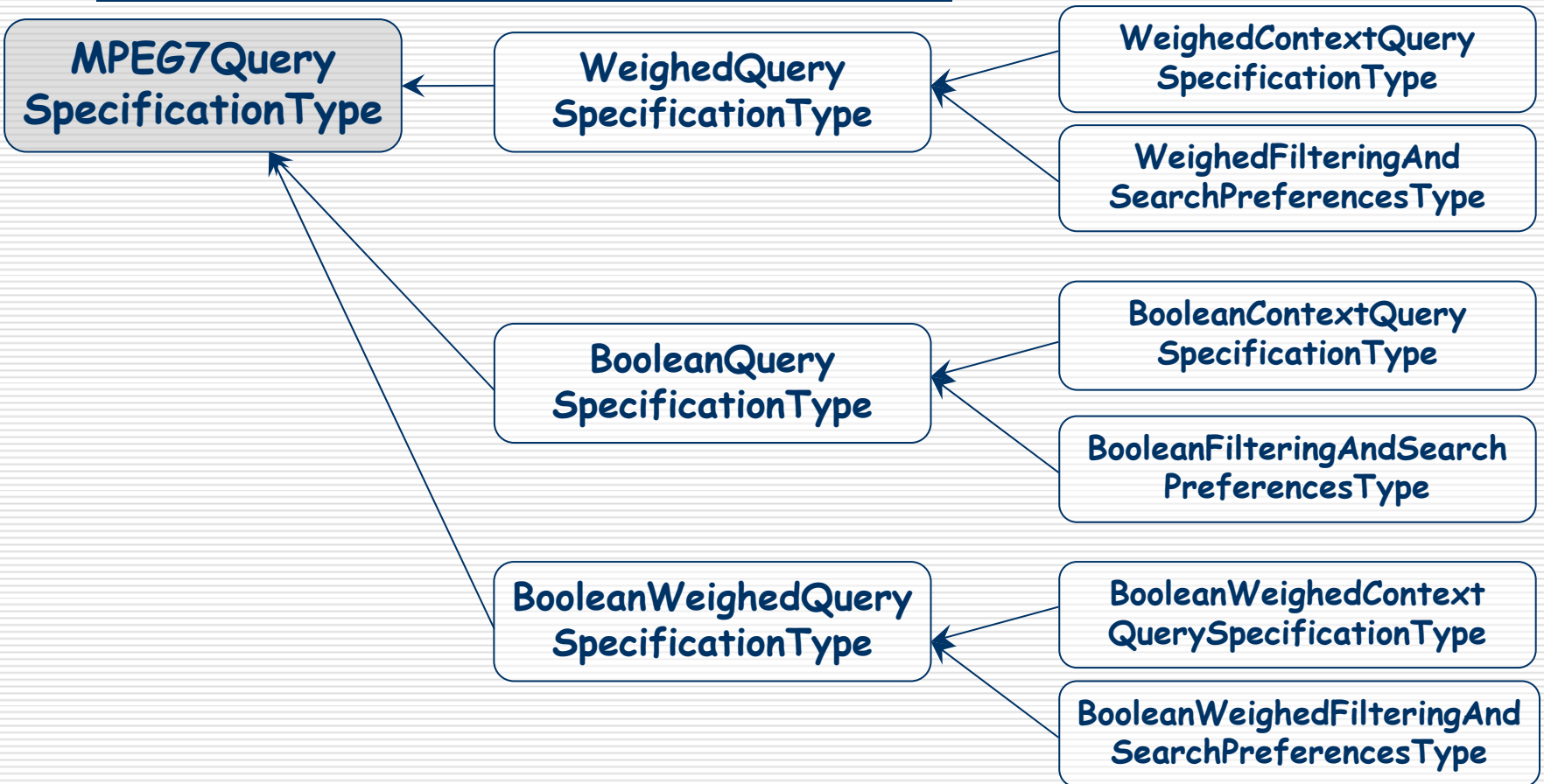
- "equals" (Default Value)
- "greaterThan"
- "greaterThanOrEqual"
- "lessThan"
- "lessThanOrEqual"

□ Variables support Joins on the features of Semantic Entities interrelated through MPEG-7 Relationships

- Semantic Entity Identifier that begins with the "\$" character

□ Allow expressing constraints on every aspect of an MPEG-7 Multimedia Object Description

MP7QL Query Specifications



Example (1)

I want the multimedia objects where
A goal is scored
by Zidane



```
<Mpeg7Query xsi:type="BooleanMpeg7QueryType">
  <QuerySpecification ANDOROperator="AND"
xsi:type="BooleanContextQuerySpecification">
  <SemanticPreferences ANDOROperator="AND">
    <SemanticBase xsi:type="BooleanEventType"
ANDOROperator="AND" NOTOperator="false">
      <Relation ANDOROperator="AND"
type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:ex
emplifies" target="soccerevents#Goal"/>
      <Relation ANDOROperator="AND"
type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:ag
ent" target="$zid"/>
    </SemanticBase>
    <SemanticBase ANDOROperator="AND"
xsi:type="BooleanAgentObjectType" id="$zid"
NOTOperator="false">
      <Relation ANDOROperator="AND" tar-
get="socceragents#PlayerObject" type="urn:mpeg:
mpeg7:cs:SemanticRelationCS:2001:exemplifies"/>
      <Agent xsi:type="BooleanPersonType">
        <Name>
          <FamilyName>Zidane</FamilyName>
          <GivenName>
            </GivenName>
          </Name>
        </Agent>
      </SemanticBase>
    </SemanticPreferences>
  </QuerySpecification>
</Mpeg7Query>
```

BQST = (EventType AND (exemplifies, Goal)) AND (agent, \$zid) AND ((\$zid, AgentObjectType) AND (exemplifies, PlayerObject, \$zid) AND (Agent(Name(FamilyName 'Zidane'))))

Example (2)

I want the multimedia objects where
A goal is scored (pv 100) or a penalty kick takes place (pv 50)

```
<Mpeg7Query xsi:type="BooleanWeighedMpeg7QueryType">  
  <QuerySpecification ANDOROperator="OR"  
    xsi:type="BooleanWeighedContextQuerySpecification">  
    <SemanticPreferences ANDOROperator="OR">  
      <SemanticBase preferenceValue="100"  
        xsi:type="BooleanWeighedEventType">  
          <Relation ANDOROperator="AND"  
            type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:exemplifies" target="soccerevents#Goal" />  
        </SemanticBase>  
      <SemanticBase preferenceValue="50"  
        xsi:type="BooleanWeighedEventType">  
          <Relation ANDOROperator="AND"  
            type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:exemplifies" target="soccerevents#PenaltyKick" />  
        </SemanticBase>  
    </SemanticPreferences>  
  </QuerySpecification>  
</Mpeg7Query>
```



Filtering and Search Preference Model

- FASPs essentially are Query Specifications
- Enhance our Semantic Preference Model [MMM06]
- Have the MPEG-7 FASPs as special Case
 - MPEG-7 FASPs have only the CreationPreferences, ClassificationPreferences, SourcePreferences and PreferenceCondition elements

Example

I am interested in multimedia objects where
A goal is scored (pv 100) and their title contains the keyword
'soccer' (pv 90)

```
<Mpeg7Query xsi:type="WeighedMpeg7QueryType">
  <QuerySpecification xsi:type="
WeighedFilteringAndSearchPreferencesType">
    <SemanticPreferences preferenceValue="100">
      <SemanticBase xsi:type="WeighedEventType">
        <Relation target="soccerevents#Goal"
type="urn:mpeg:mpeg7:cs:SemanticRelationCS:2001:
exemplifies"/>
      </SemanticBase>
    </SemanticPreferences>
    <CreationPreferences>
      <Title preferenceValue="90"
stringComparisonOperator="keywords">
        soccer
      </Title>
    </CreationPreferences>
  </QuerySpecification>
</Mpeg7Query>
```



Conclusions

- MP7QL is a Language for Querying MPEG-7 Descriptions
- Compatible FASP Model
- MP7QL allows:
 - Uniform and Transparent MPEG-7 Retrieval and Filtering
 - Querying every Aspect of an MPEG-7 Multimedia Object Description
 - Explicit Specification of Boolean Operators and Preference Values
- The MP7QL queries may utilize the User Preferences as Context
 - Allow for Personalized Multimedia Content Retrieval
- The MP7QL Design has taken into account the MP7QF
- Expressed both in XML Schema and OWL
 - Available at http://elikonas.ced.tuc.gr/Queries/MP7QL_XS.zip and http://elikonas.ced.tuc.gr/Queries/MP7QL_OWL.zip
- An implementation of the XML Schema version of MP7QL is under way on top of an XML repository accessed by XQuery

Future Work

- Implementation of both the MP7QL Syntax Expressions
- Evaluation of the MP7QL Implementations