VK Multimedia Information Systems

Mathias Lux, mlux@itec.uni-klu.ac.at

Dienstags, 16.oo Uhr c.t., E.2.69

Contents

- **Introduction to Metadata**
- Metadata Formats
  - Media Production
  - Ontologies
  - Home User
  - MPEG-7
- Exercise 5

What is Metadata?

Metadata is Data about Data

Meta^2 data is data about metadata

Metadata Applications

- Retrieval & Browsing
  - No need to download / view the whole video
  - Push vs. Pull
- Management & Organization
  - Rights, Billing, Ordering, Classification
- Adaptation
  - Transformation to appropriate representation
- Service Description
  - Orchestration, Harmonization, Access
  - On technical and semantic level

Metadata Problems

- Interoperability
  - Complexity of Metadata vs. Integration in (different) applications
- Preservation
  - Readability in 100, 1000 years
  - Description how to decode ...
- Transmission
  - Synchronized, partially, etc.
- Timeliness
  - Changing with audiovisual content while editing?

Aspects of Metadata

- Content Description
- Administrative Aspects
- Quality Metadata
- Legal Metadata
- Technical Metadata

Aspects of Metadata: Content Description

- Agenda
  - Overview on sequence of information to particular topic
- Table of Contents
  - A list of all segments and their position
- Abstract
  - Describes the topic of a content within a few sentences
- Preface
  - Some words of the author …
- Structure
  - For consumption & navigation

Aspects of Metadata: Content Description

- Key words & index
  - Content description and lookup of concepts
- Summary
  - Overview of the most important aspects
- Literature reference & footnotes
  - Additional material
- Comments
  - For interactive environments
- Categories
  - Conceptual classification in taxonomies (genre etc.)
- Languages
  - Which languages are used / available

Aspects of Metadata: Administrative Metadata

- Associated persons
  - Authors: Who created the content
  - Contributors: Who contributed to the content
- History of Changes
  - Changes in content and metadata
  - with author, date, location and sort of action
- Unique identifier
  - e.g. URI or database id
- Versions
  - Versioning information … related to the history

Aspects of Metadata: Quality Aspects

- Weight
  - Prioritization of segments
- Expiration Date
  - Time period of validity of the content
- Recessions
  - Opinions, arguments from others
- Process description & history
  - Who corrected, translated and approved the content e.g. within an workflow
- Quality Assessment
  - Rating of the (e.g. visual) quality of the content

Aspects of Metatdata: Legal Metadata

- Copyright
  - Person or company legally permitted to sell or trade with the content
- Publish Date
  - Date when the content has been released to public
- License Model
  - Defines how consumers are allowed to reuse the content

Aspects of Metadata: Technical Metadata

- Standards
  - Description of the standardized structure in which the content and the metadata are stored
- Application/System
  - Application the content and metadata can be / has been processed
- Resolution, compression of pictures or video clips
- Encryption Method
  - In case of encrypted content
- Storage Media
  - On which the content has been stored e.g. CDs, tapes, MO, paper etc.
- Logs
  - Technical history

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Standards Preface: XML

- eXtensible Markup Language
- Recommendation by the W3C
  - Simplification of SGML
- Base language for many other recommendations
  - SVG, XHTML, SMIL, ...

XML: Overview

- Header identifying version & coding
- Tree-like structure
- Simple structuring elements
  - Tags & attributes (Markup)
  - Entities
- Offers DTD and XML Schema
  - DTD is ‘simple’ and small
  - XML Schema is XML based and rather powerful
  - Relax NG is another option

XML Benefits

- Existing Parsers
  - Document Object Model (DOM)
    - Tree structure in memory
    - Access through navigation in tree
  - Simple API for XML (SAX)
    - Event based, sequential
    - Nothing in memory
- Only schema of data has to be defined
  - ‘Old’ pitfalls removed
  - Parsers are rather simple

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Media Production: Dublin Core

- Aims to provide
  - Common denominator for metadata
  - Simple yet powerful schema
- Dublin Core Metadata Initiative defined
  - 15 elements (author, date, title, type, ...)
  - Further refinements (creation date, extent, ...)
- Dublin Core does not provide
  - A schema for storage
  - A schema for data types (e.g. dates)

Media Production: EBU P/Meta

- Aims to provide ...
  - a universal standard for metadata exchanges between professional media organizations
  - a definition of common meaning to the data fields and values that most broadcasters use in order to enable exchanges
  - designed for use in a wide range of broadcasting activities
  - both language and system independent
  - a joint development by EBU (European Broadcasting Union) members on a not-for-profit basis
  - a scheme that makes use of other standards where possible, e.g. ISO country codes

Media Production: Other Standards

- SMPTE Metadata Dictionary
  - Society of Motion Picture and Television Engineers
    - Since 1916, 61 members
  - Standard for metadata exchange in TV
  - Defines set of attributes / fields
- MXF DMS-1
  - Metadata bundled with the Material Exchange Format (MXF)
  - Open format for the broadcasting area (SMPTE + EBU)
- Virtually ‘no information’ about these is available
  - Just for exchange for insiders
  - Might not be royalty free

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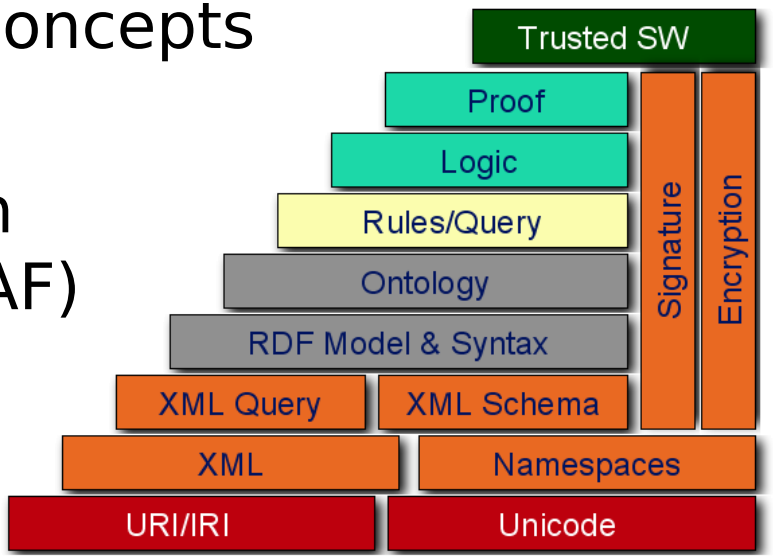
Ontologies: RDF

- Metadata Model published by the W3C
  - Reaction on the insufficiency of HTML metadata for search & inference
  - Based on “Subject – Predicate – Object” triples
  - Uses URIs for identifying concepts
  - Spans a directed graph
  - Is used in conjunction with vocabularies (e.g. DC, FOAF)



Ontologies: SKOS

- Simple Knowledge Organization System
  - RDF Vocabulary for KOS
- Knowledge Organization Systems are
  - Taxonomies, Thesaurii, Classification Schemes, etc.
- Can be used to organize multimedia data

Ontologies MMSEM

- Multimedia Semantics : Incubator Activity of the W3C
  - Closed Aug. 2007

Deliverables:

- Image Annotation on the Semantic Web.
  - use cases and general discussion about Semantic Web vocabularies and tools
- Multimedia Annotation Interoperability Framework.
  - a bottom-up approach to provide a simple extensible framework to improve interoperability
- MPEG-7 and the Semantic Web.
  - four current OWL/RDF proposals of MPEG-7, as well as a comparison of the different modeling approaches in the context of practical applications.

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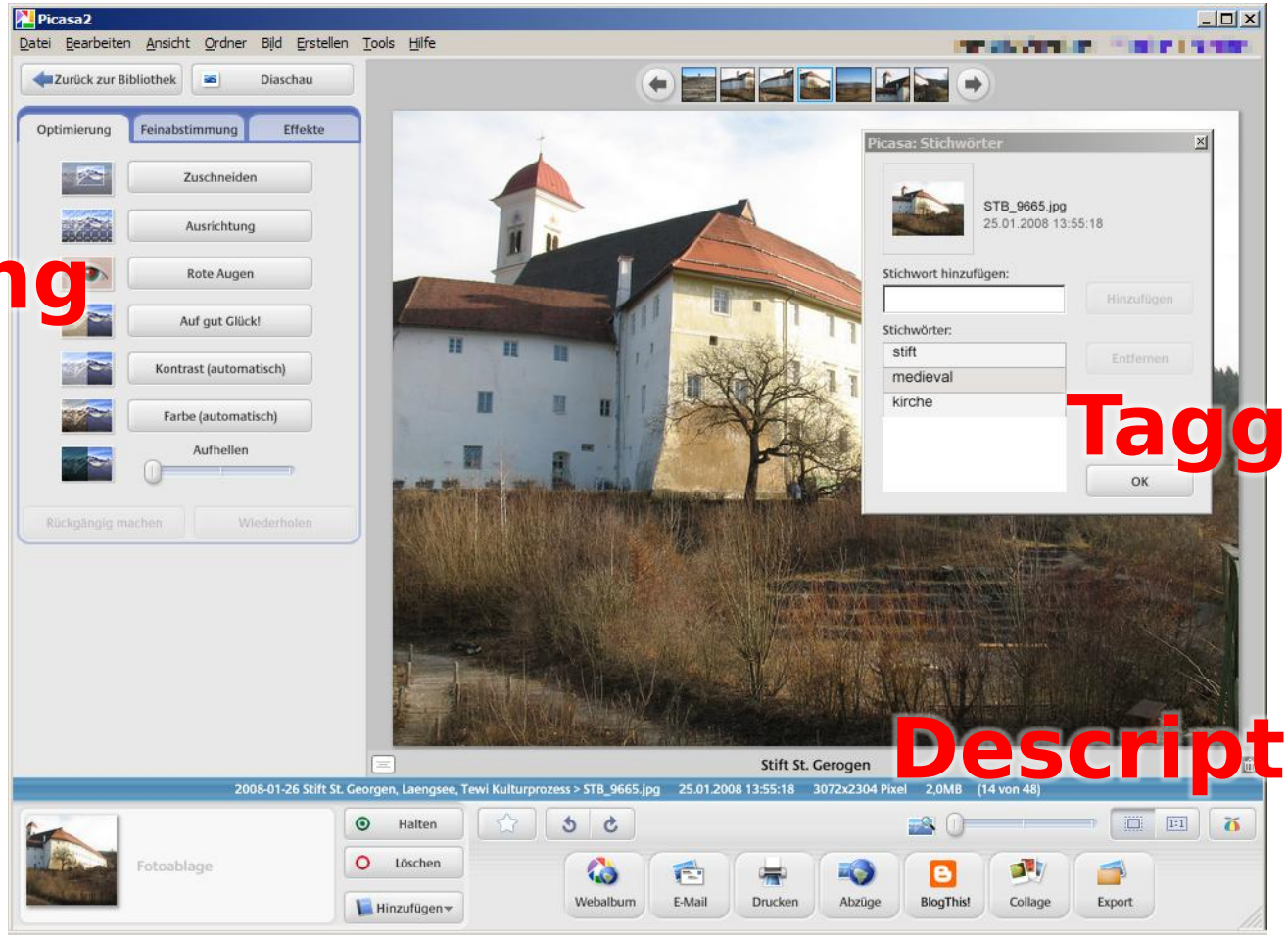
Home User: Metadata Applications

Editing

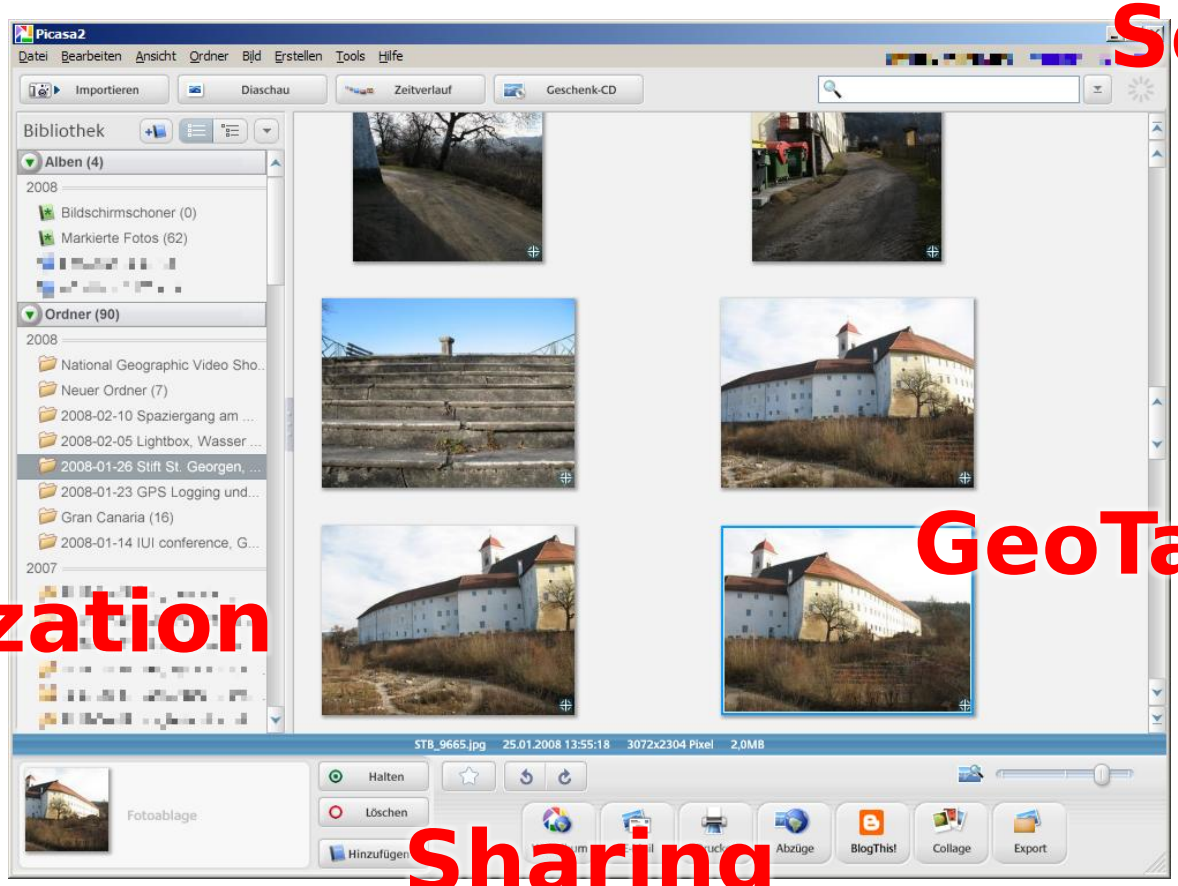


Tagging

Descriptions

Home User: Metadata Applications

Search



Organization

GeoTagging

Sharing

Home User: EXIF

- Exchangeable Image File Format (EXIF)
  - Japan Electronic and Information Technology Industries Association (JEITA)
  - Extensive format for technical aspects
  - Settings and sensor reading at the time of recording
  - Mostly images from digital cameras

EXIF - Example

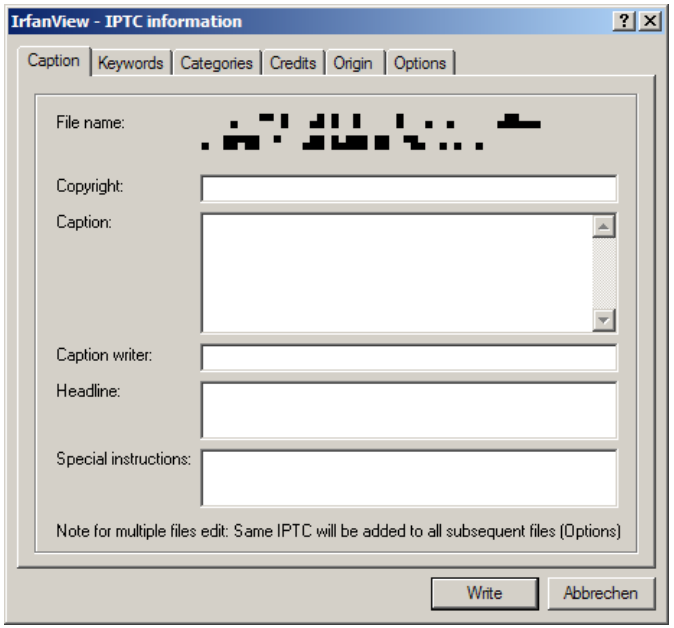

```
Make - Canon
Model - Canon PowerShot A620
Orientation - Top left
XResolution - 180
YResolution - 180
ResolutionUnit - Inch
DateTime - 2008:02:10 15:44:58
YCbCrPositioning - Centered
ExifOffset - 198
ExposureTime - 1/200 seconds
FNumber - 2.80
ExifVersion - 0220
DateTimeOriginal - 2008:02:10 15:44:58
DateTimeDigitized - 2008:02:10 15:44:58
ComponentsConfiguration - YCbCr
CompressedBitsPerPixel - 5 (bits/pixel)
ShutterSpeedValue - 1/202 seconds
ApertureValue - F 2.80
ExposureBiasValue - 0.00
MaxApertureValue - F 2.80
```

```
GPS information: -
GPSVersionID - 2.2.0.0
GPSLatitudeRef - N
GPSLatitude - 46  40  41.41
GPSLongitudeRef - E
GPSLongitude - 13  58  22.17
GPSAltitudeRef - Sea level
GPSAltitude - 503 m
GPSTimeStamp - 14  44  58

Maker Note (Vendor): -
Macro mode - Normal
Self timer - Off
Quality - Superfine
Flash mode - Auto + red-eye reduction
Sequence mode - Single or Timer
Focus mode - Single
Image size - Large
Easy shooting mode - Portrait
Digital zoom - None
```

Home User: IPTC

- IPTC Information Interchange Model (IIM)
  - Several elements to describe images (assets)
  - Often used in applications
    - Adobe Bridge / Photoshop
    - Google Picasa
    - Irfanview ...
  - Like a *predefined metadata form* ->



Home User

- eXtensible Metadata Platform (XMP)
  - Initiative from Adobe
  - Based on RDF, embedded in document
  - Also used in PDF, AI, PSD, etc.
- ID3
  - Metadata for MP3, spread by popular players
  - Two versions ...
    - v1: 128 Byte block coding some fields at end of file
    - v2: Several optional tags inside stream

Broadcasting + iTV

- Electronic Program Guide (EPG)
  - In use in conjunction with DVB
  - Simple format in additional stream
- Multimedia Home Platform (MHP)
  - In use in Austrian DVB-T
  - Proprietary format for data + function
  - Based on Java

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MPEG-7

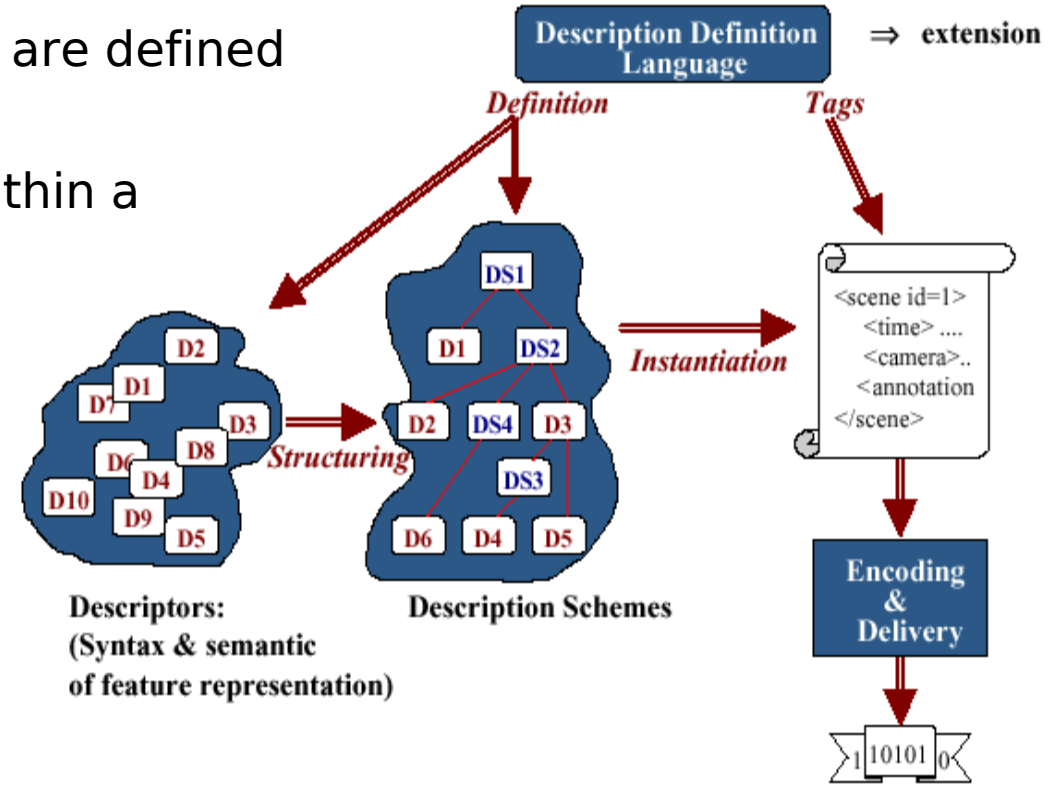
- ISO/IEC Standard: **Multimedia Content Description Interface**
- Moving Pictures Expert Group
  - Specification goes on ...
- It's based on XML (Schema)
  - Binary representations possible (BiM)
- Allows differing granularity of descriptions
  - Extensive to very simple

MPEG-7 History

- Call for Proposals: October 1998
- Evaluation: February 1999
- First version of Working Draft (WD): December 1999
- Committee Draft (CD): October 2000
- Final Committee Draft (FCD): February 2001
- Final Draft International Standard (FDIS): July 2001
- International Standard (IS): September 2001

MPEG-7 Basics

- Descriptors
  - Syntax and semantics of exactly one (low or high level) elementary feature
  - Also base data types are defined
- Description Schemes
  - Defines structures within a framework
- Description Definition Language (DDL)
  - Extension of XML Schemes
- Coding Schemes
  - Create and interpret descriptions in BiM



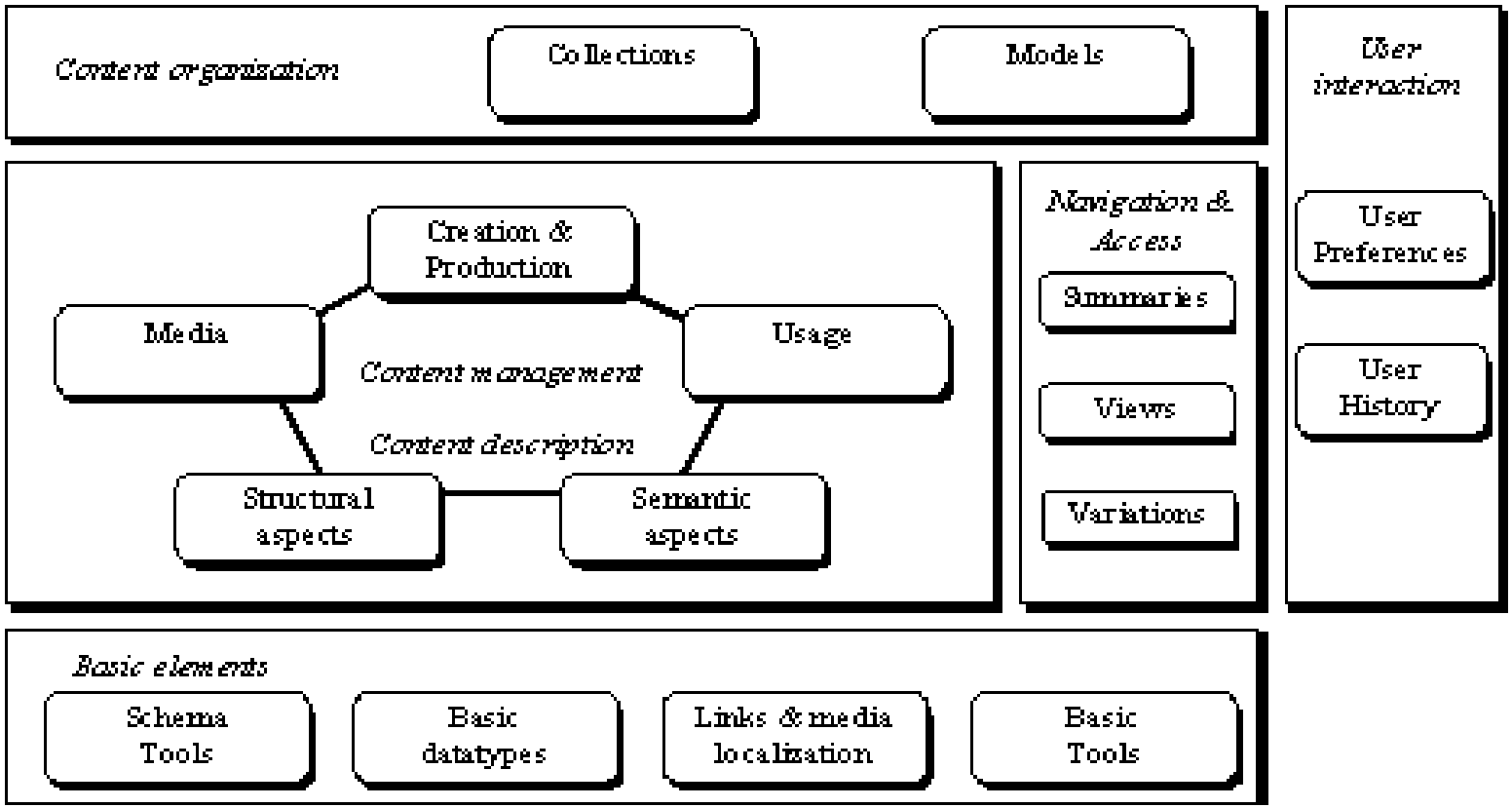
MPEG-7 Parts

1. MPEG-7 Systems
   - Tools needed to prepare MPEG-7 descriptions for efficient transport and storage and the terminal architecture.
2. MPEG-7 Description Definition Language
   - Language for defining the syntax of the MPEG-7 Description Tools and for defining new Description Schemes.
3. MPEG-7 Visual
   - Description Tools dealing with (only) visual descriptions.
4. MPEG-7 Audio
   - Description Tools dealing with (only) audio descriptions.
5. MPEG-7 Multimedia Description Schemes
   - Description Tools dealing with generic features and multimedia descriptions.

MPEG-7 Parts

6. MPEG-7 Reference Software
   - Implementation of relevant parts of the MPEG-7 Standard with normative status.
7. MPEG-7 Conformance Testing
   - Guidelines and procedures for testing conformance of MPEG-7 implementations
8. MPEG-7 Extraction and Use of Descriptions
   - Informative material about the extraction and use of some of the Description Tools.
9. MPEG-7 Profiles and levels
   - Provides guidelines and standard profiles.
10. MPEG-7 Schema Definition
    - Specifies the schema using the Description Definition Language

Scope of MPEG-7



from: http://www.chiariglione.org/mpeg/standards/mpeg-7/mpeg-7.htm

Basic Elements

Basic elements are fundamental constructs and used throughout the whole MPEG-7 description

- Basic datatypes
  - Time and date, relative and absolute
  - Numeric datatypes like matrices and vectors
- Links & Media Localization
  - Interconnections and content linking

Navigation & Access

- Descriptors for Browsing & Retrieval
  - Summaries
  - Partitions (time, space & frequency)
  - Decompositions (time, space & frequency)
  - Variations

User Interaction

- Pertaining consumption of AV data
  - user preferences
  - usage history
- Meant to facilitate personalization
  - Matching User Interaction DS with content description
  - Is research topic @ ITEC

Content Organization

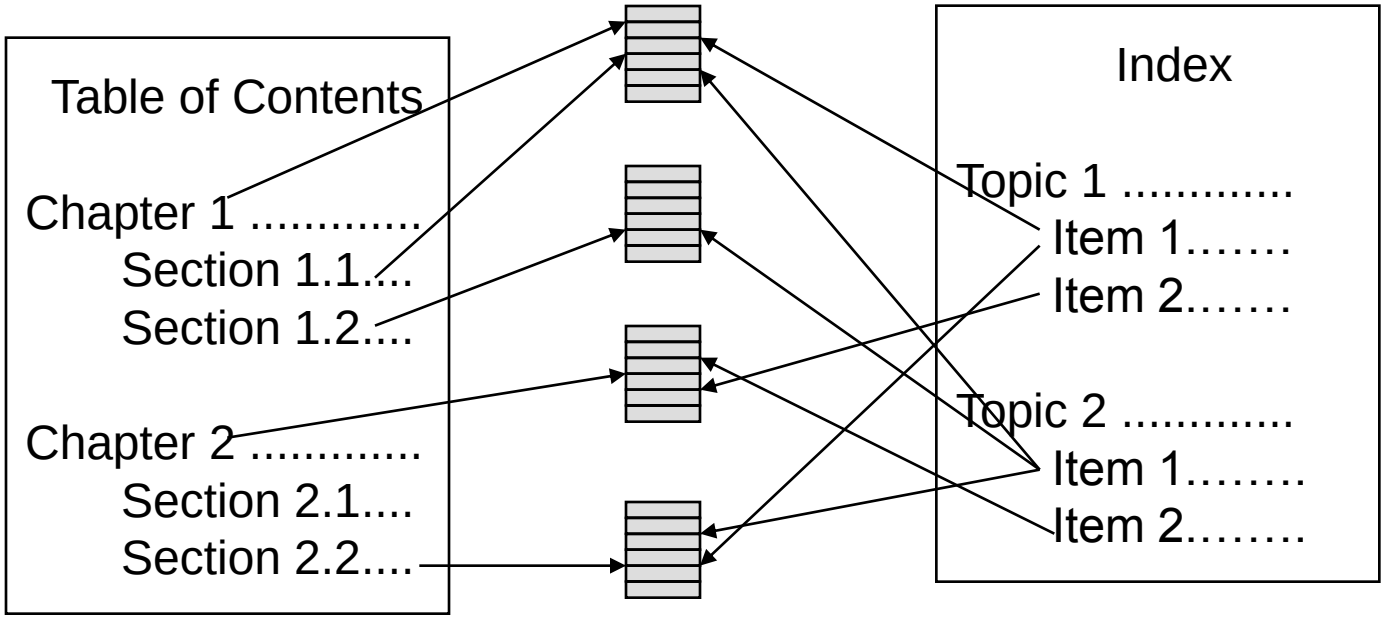
- Organization & modelling of collections
  - Audio-visual content, segments, events, and/or objects
    - E.g. pictures, scenes, music files, etc.
  - Allows collection description as a whole
    - E.g. “Pictures of my holiday in Ebonia”

Content Management

- Creation & Classification
  - Title, textual annotation, creators, creation locations, and dates.
  - Categories such as genre, subject, purpose or language.
  - Review and guidance information: Age classification, parental guidance, and subjective review.
  - Related material information.
- Media coding, storage & file formats
  - Media profiles & master media
- Content Usage
  - Usage rights, usage record, and financial information

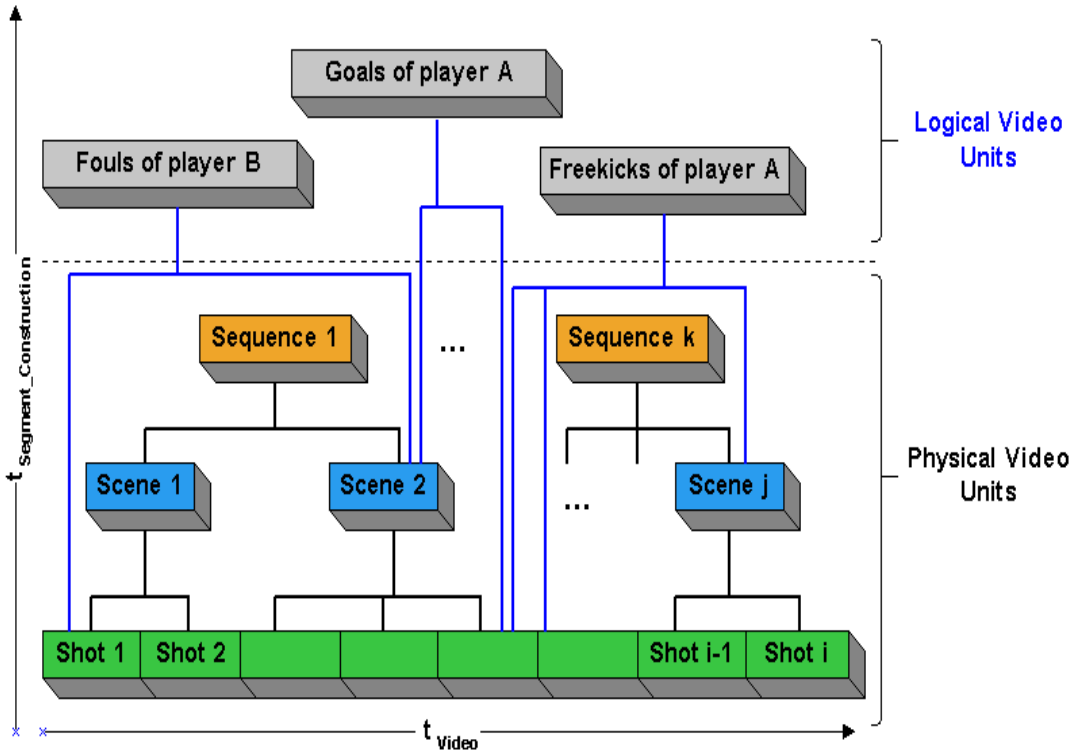
Content Description: Structural vs. Conceptual Aspects

- Program DS (in sense of TV program)
- Analogy to
  - Table of content – Region tree (linear partitioning)
  - Index – Object tree (non-linear structure)

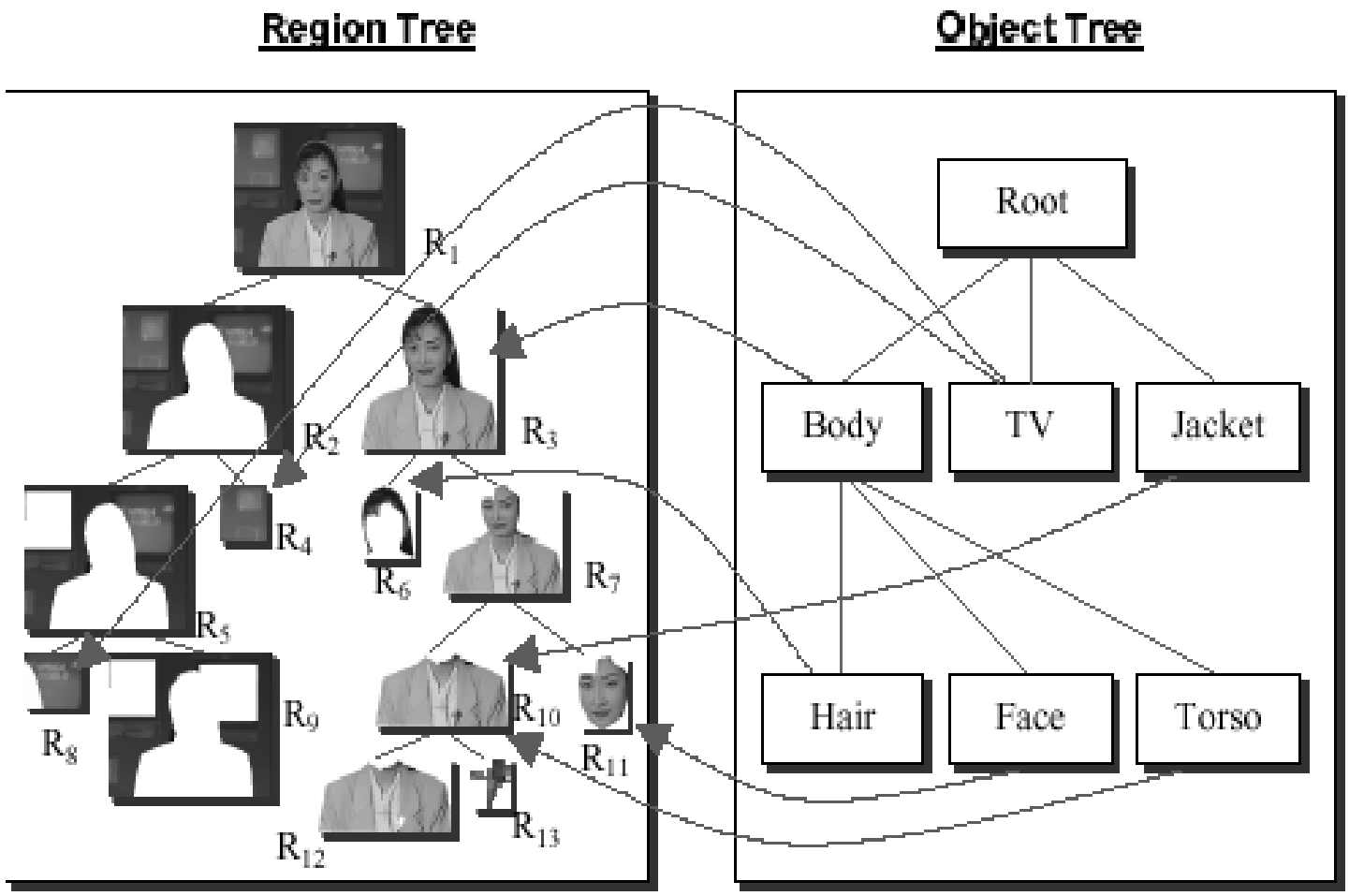


Content Description: Structural Aspects

- Divide a video stream into physical and logical video segments
- The higher the level of a physical video unit, the more semantic information is necessary
- Logical units are based on semantic content



Region and Object Trees



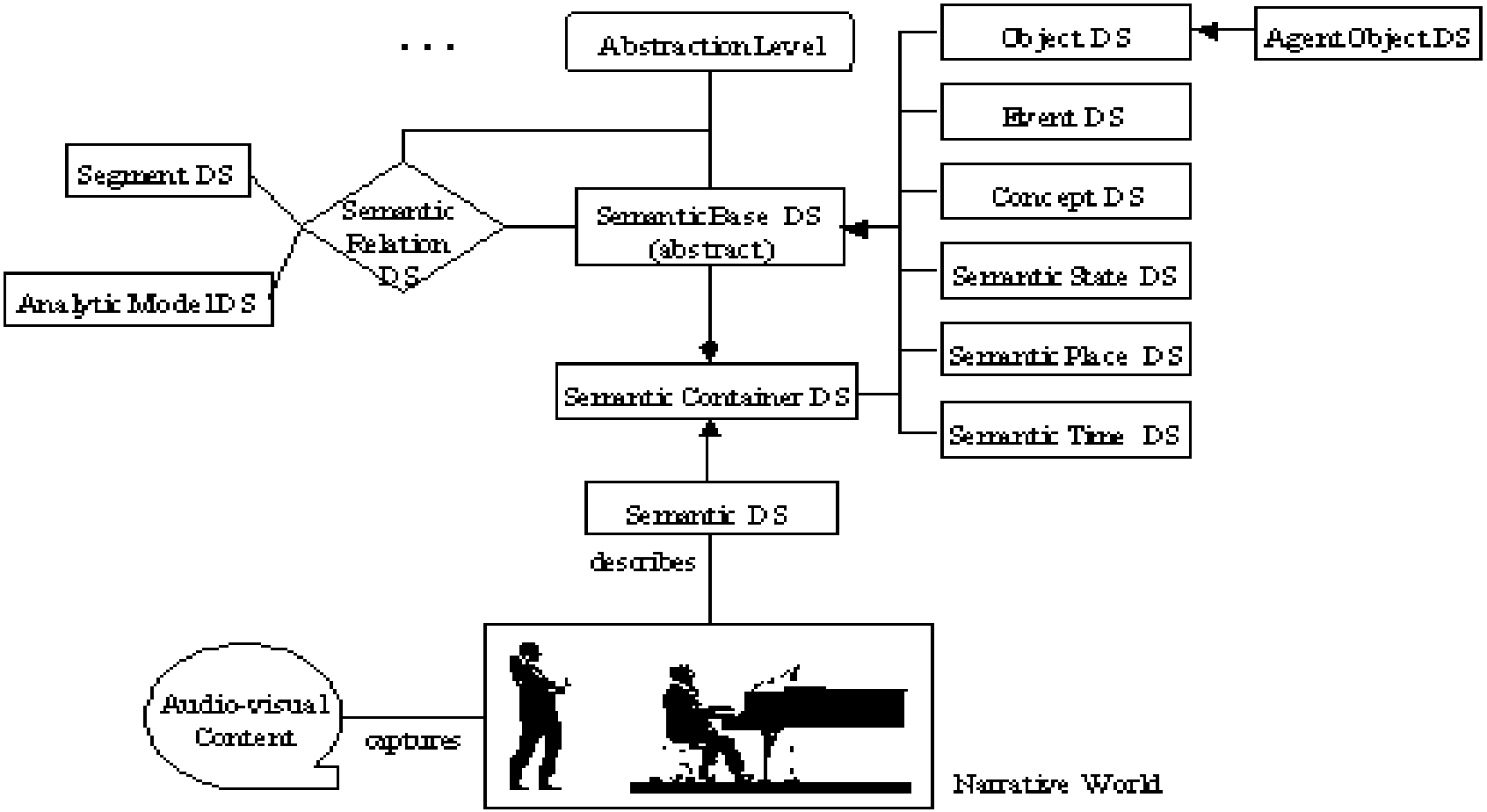
Content Description: Semantic Aspects

- Low Level Features
  - Extraction from Content
  - Descriptors for
    - Shape, color, texture (visual)
    - Timbre, rhythm (audio)
- High Level Features
  - Annotation
  - So called *semantic descriptors*
    - Textual information
    - Conceptual information

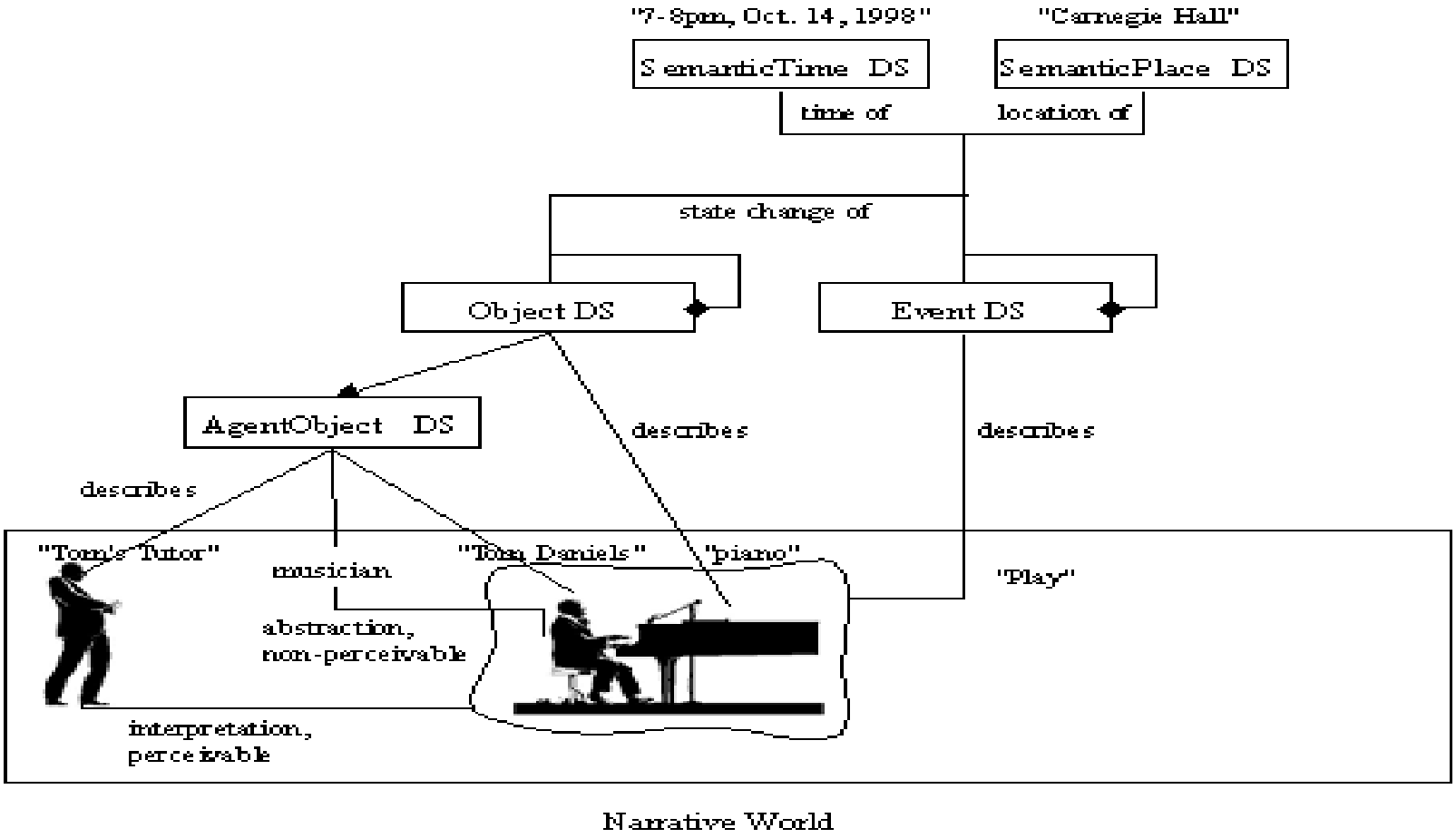
MPEG-7 High Level Descriptors

- Textual Descriptions
  - Text to describe temporal / spatial regions
- The W's
  - Structured way of textual descriptions
    - Who, Where, What Object, When, Why, How & Where
- Instead of textual descriptions
  - Controlled Terms
    - Dictionaries, Taxonomies, Classifications Schemes
  - Semantic Description Scheme

MPEG-7 Semantic Description Scheme



Actual Description in MPEG-7



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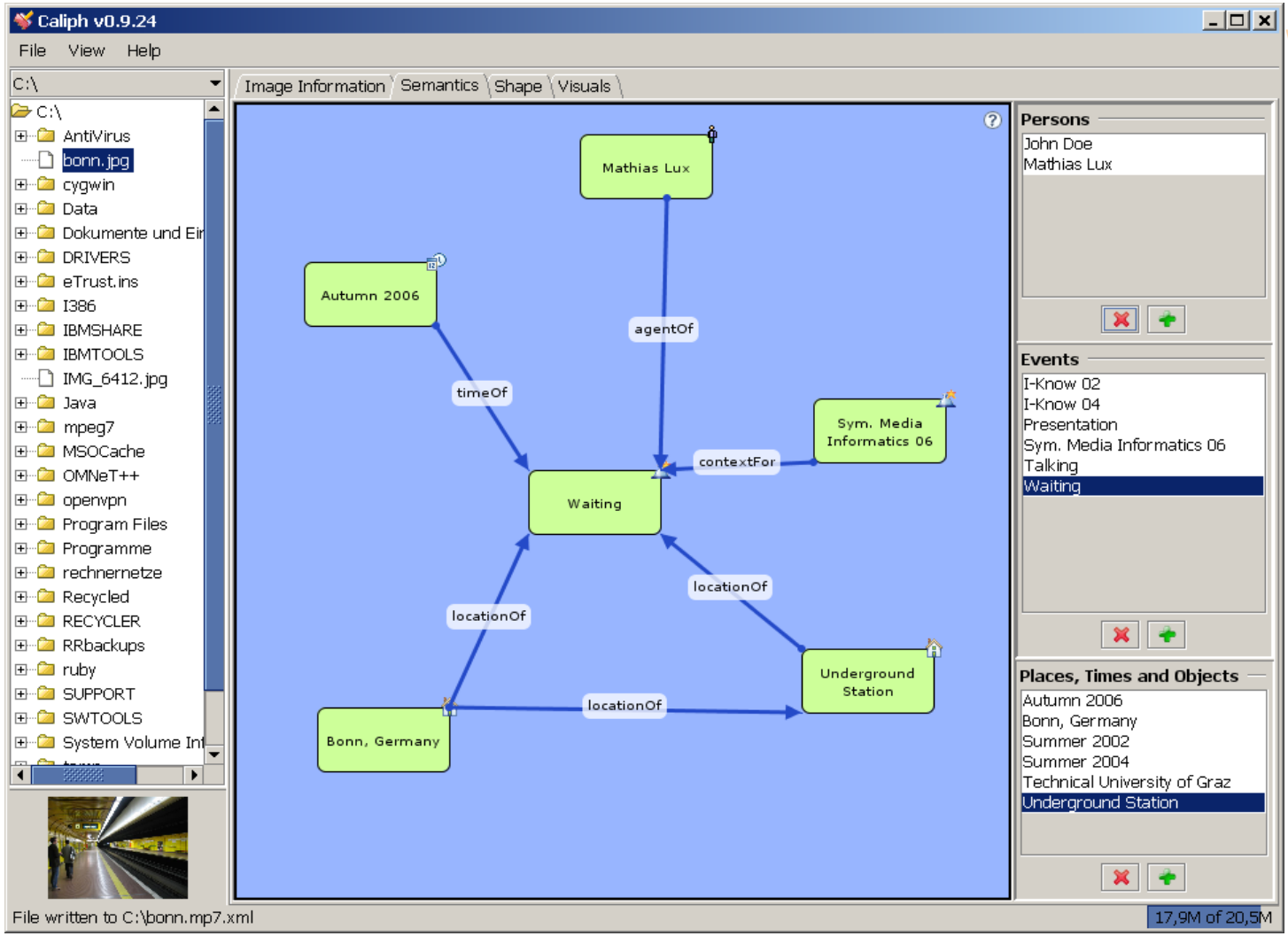
Exercise 5

- Go to http://www.semanticmetadata.net
- Download & start Caliph & Emir
  - You will need Java JRE 1.6
  - You may use the webstart option
- Annotate a photo of your choice (e.g. some Flickr photo)
  - Fill in all annotation fields in the first tab
  - Create a semantic annotation in the second tab
- Send me the annotation and a summary of your experience (2 sentences are sufficient)

Demo


Caliph v0.9.24
File View Help
C:\
AntiVirus
bonn.jpg
cygwin
Data
DRIVERS
eTrust.ins
I386
IBMSHARE
IBMTOOLS
IMG_6412.jpg
Java
mpeg7
MSOCache
OMNeT++
openvpn
Program Files
Programme
rechnernetze
Recycled
RECYCLER
RRbackups
ruby
SUPPORT
SWTOOLS
Image Information
Semantics
Shape
Visuals
Mathias Lux
Autumn 2006
agentOf
timeOf
Sym. Media Informatics 06
contextFor
Waiting
locationOf
locationOf
Underground Station
locationOf
Bonn, Germany
Persons
John Doe
Mathias Lux
Events
I-Know 02
I-Know 04
Presentation
Sym. Media Informatics 06
Talking
Waiting
Places, Times and Objects
Autumn 2006
Bonn, Germany
Summer 2002
Summer 2004
Technical University of Graz
Underground Station
File written to C:\bonn.mp7.xml
17,9M of 20,5M