Semantic Annotations in Use

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Semantic Annotations in Use

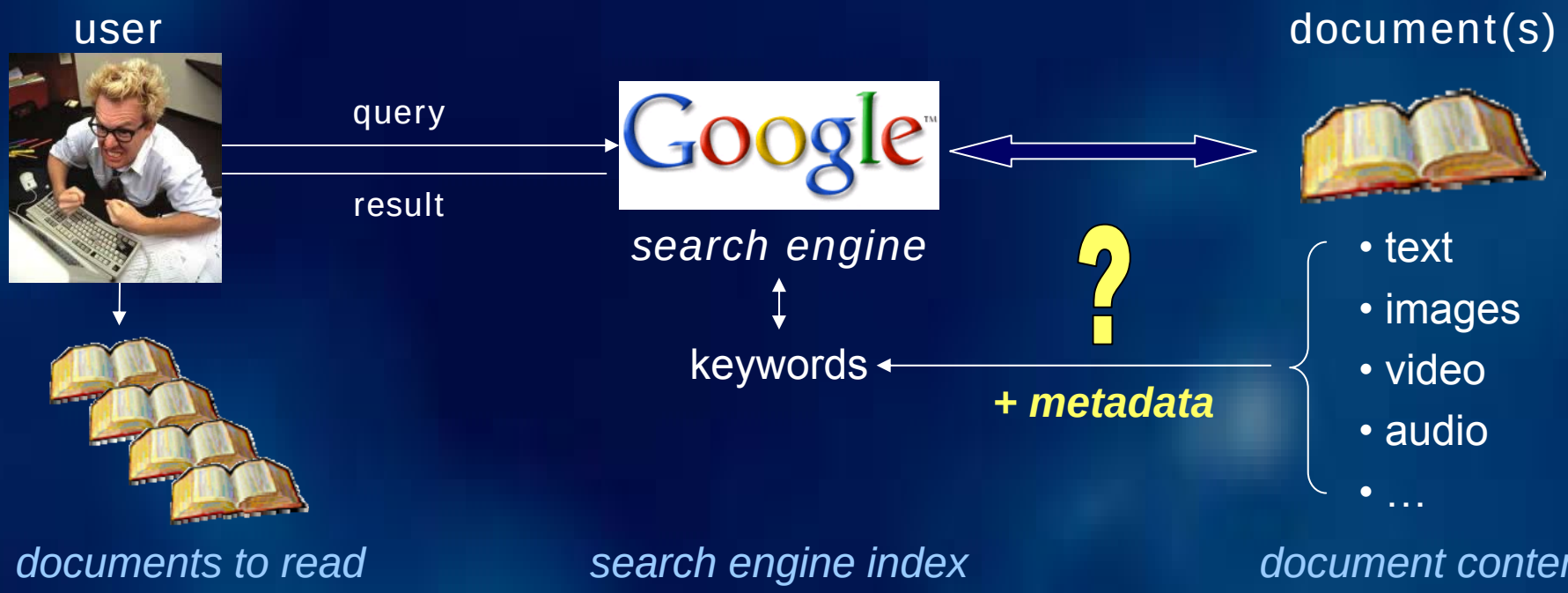
Outline

- Tags and Dependencies –
  an Integrated View on Document Annotation
- Osotis –
  Automated and Collaborative Annotation of
  Multimedia Presentations
- NPBibSearch –
  Ontology Enhance Bibliographic Search

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Searching the WWW today**
  - document retrieval
  - keyword based search



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Metadata**

document

+ metadata ?

semantic annotation

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE rdf:RDF [
 <!ENTITY rdf 'http://www.w3.org/1999/02/22-rdf-syntax-ns#'>
 <!ENTITY rdfs 'http://www.w3.org/2000/01/rdf-schema#'>
 <!ENTITY owl 'http://www.w3.org/2002/07/owl#'>
 <!ENTITY swrc 'http://swrc.ontoware.org/ontology#'>
 <!ENTITY xsd 'http://www.w3.org/2001/XMLSchema#'>
]>
<rdf:RDF
xml:base="http://www.aifb.uni-karlsruhe.de/Publikationen/viewPublikatio
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:swrc="http://swrc.ontoware.org/ontology#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
<owl:Ontology rdf:about="">
 <rdfs:comment>Instance data for publication "Proceedings of the First
 Workshop on Ontology Learning OL'2000, Berlin, Germany, August 25,
 2000."</rdfs:comment>
```

Solution 1: manual annotation
Problem: not efficient (expensive)

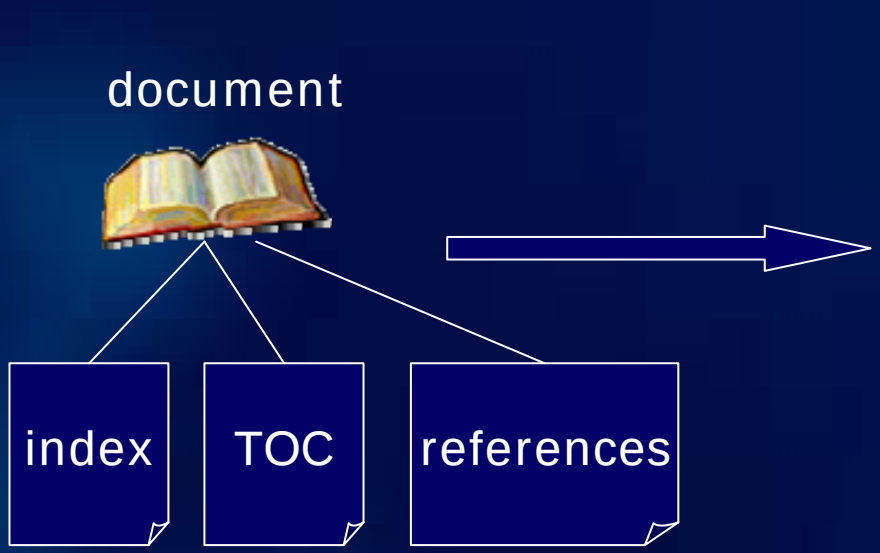
Solution 2: data mining and automatic annotation
Problem: domain dependent, unreliable,...

⇆ both solutions alone are unsatisfying ....

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **There is already (often unused) Metadata**



semantic annotation

```
<?xml version="1.0" encoding="ISO-8859-1"?>
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 <!ENTITY owl 'http://www.w3.org/2002/07/owl#'>
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 <!ENTITY xsd 'http://www.w3.org/2001/XMLSchema#'>
]>
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xml:base="http://www.aifb.uni-karlsruhe.de/Publikationen/viewPublikatio
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xmlns:owl="http://www.w3.org/2002/07/owl#"
xmlns:swrc="http://swrc.ontoware.org/ontology#"
xmlns:xsd="http://www.w3.org/2001/XMLSchema#">
<owl:Ontology rdf:about="">
 <rdfs:comment>Instance data for publication "Proceedings of the First
 Workshop on Ontology Learning OL'2000, Berlin, Germany, August 25,
 2000."</rdfs:comment>
```
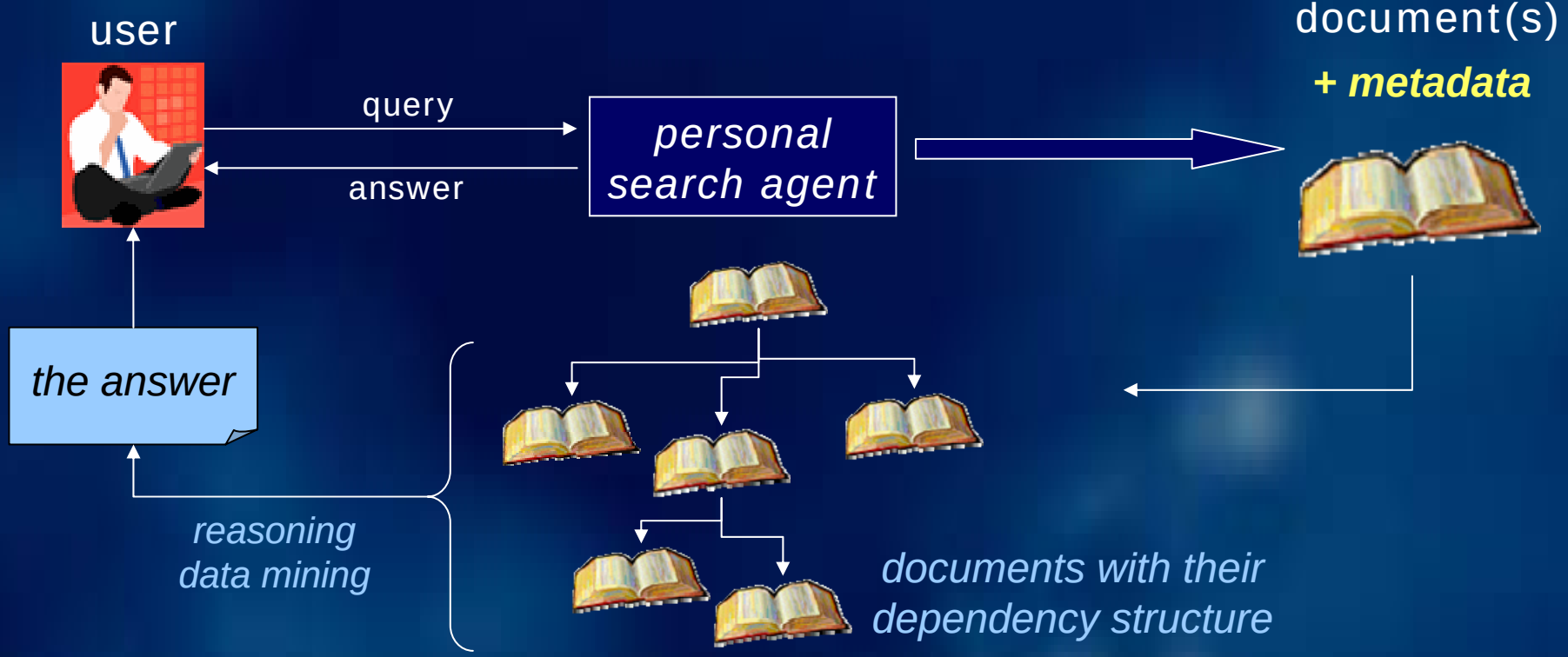

index	**conceptual knowledge**	basis of semantic document annotation
TOC	**structural knowledge**	
references	**referential knowledge**	

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Searching the WWW tomorrow (?)**
  - fact retrieval (or at least extended document retrieval)
  - content based search



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Documents, Tags, and Annotations**

document

consists of

annotations $\subseteq$ strings

associate distinguished
document parts with metadata

```
<b> Lorem</b> ipsum dolor sit amet,
<br/>consectetuer adipiscing elit.
<br/> <a href="……" title=".."/>
Sed orci purus, semper eget, <br/>
tristique quis, adipiscing <br/>
<!--<rdf:annotation user="…"
  tag="…"…/> posuere, erat.
Aenean <br/> ultricies odio id sem.
Sed <br/><h1> nec felis sit amet
ante </h1>
tempor sagittis. Vestibulum <br/>
est nunc, lobortis cursus, <br/>
semper vel, pulvinar sed, <br/>
odio. Vestibulum blandit…
```

smallest addressable document unit

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Documents, Tags, and Annotations**
  - Examples

book

- smallest document unit: word
- higher order units: sentence, paragraph, page, chapter, part, …

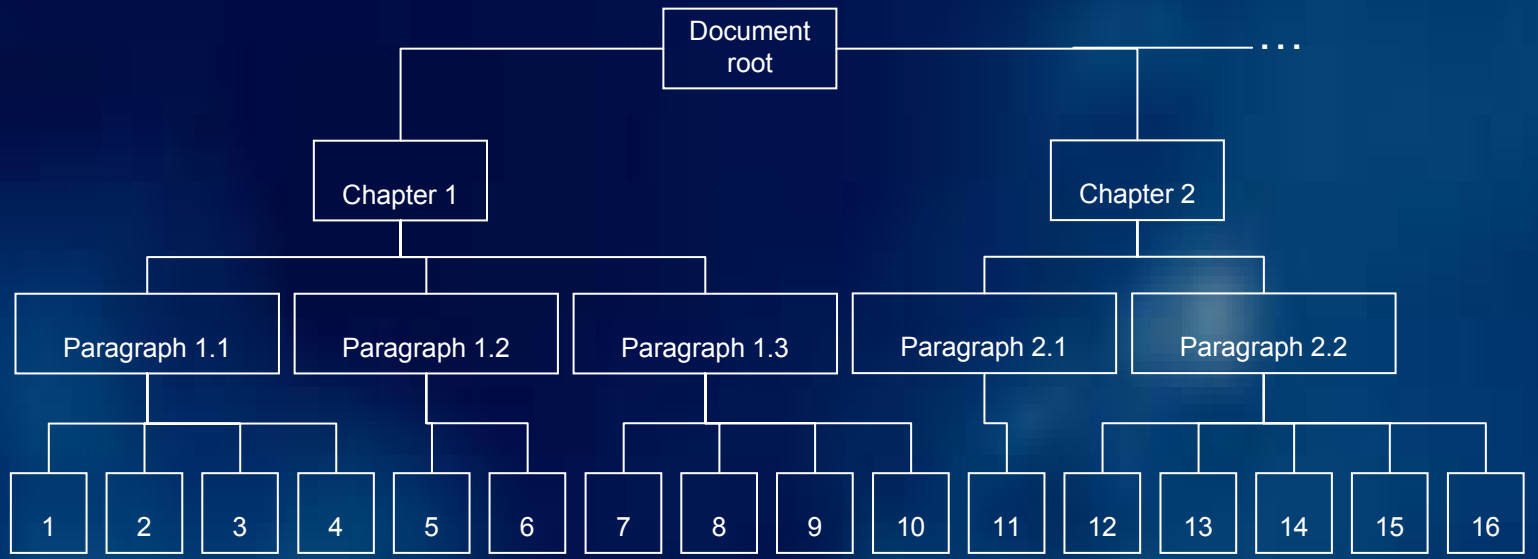
video

- smallest document unit: pixel
- higher order units: blocks, macro blocks, slices, frames, objects, scenes, acts,…

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

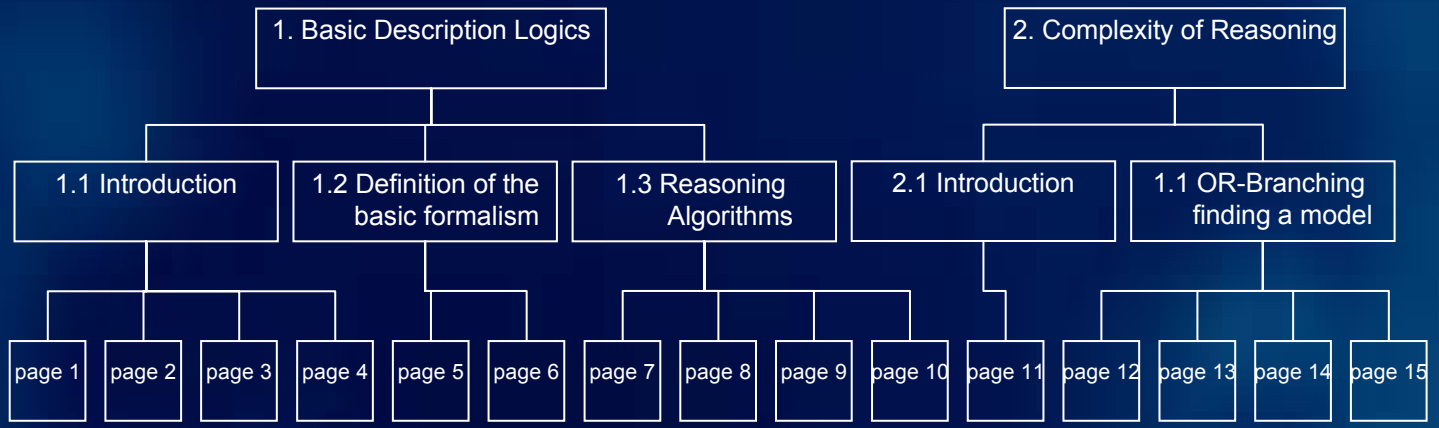
- **Logical Document Structure**
  - Structural tags
    - can be specified
      - explicitely (structural information) or
      - implicitely (formatting information)
    - can be associated with names/titles
    - can be used for document navigation



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Logical Document Structure**
  - Table of Contents (TOC) from structural tags



1. Basic Description Logics 1
   1. Introduction 1
   2. Definition of the basic formalism 5
   3. Reasoning algirithms 7
2. Complexity of Reasoning 11
   1. Introduction 11
   2. OR-Branching: finding a model 12

Semantic Annotations in Use

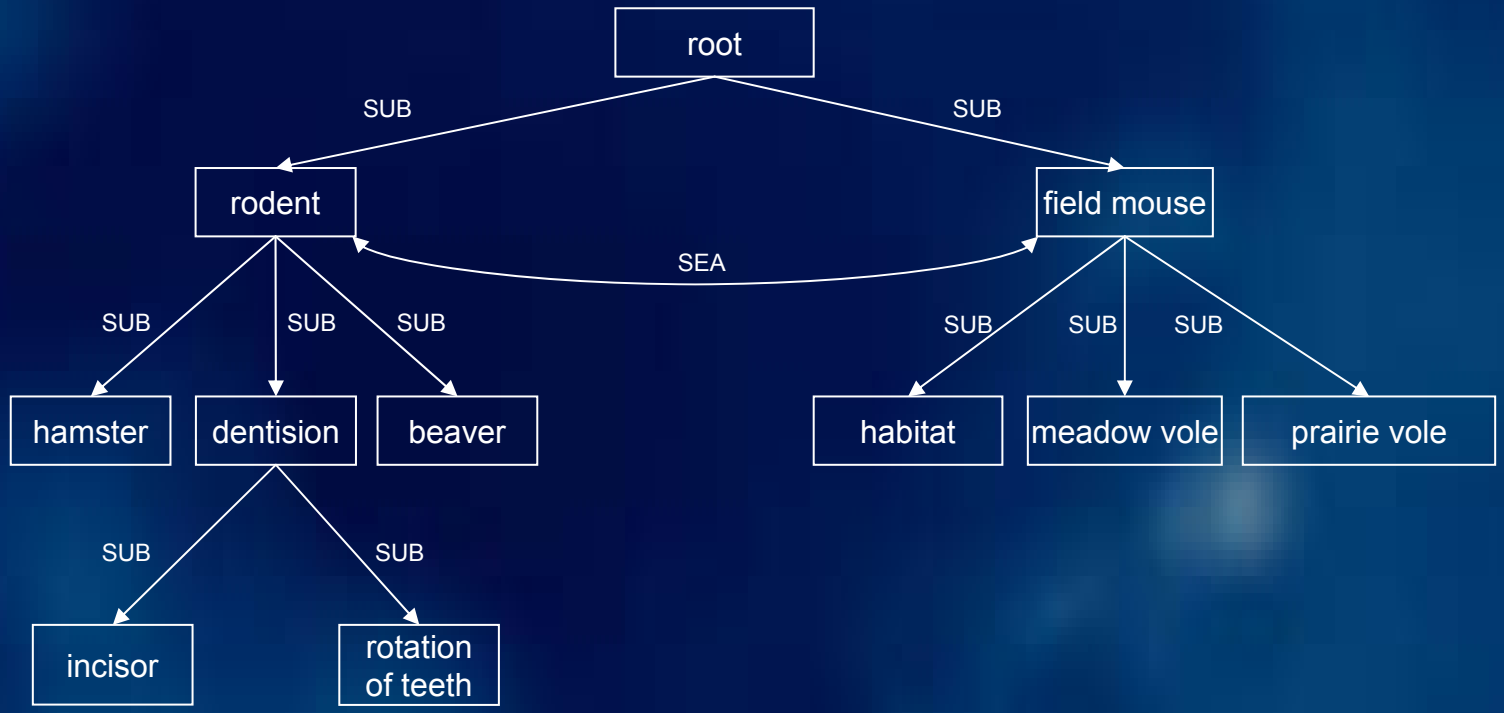
Tags and Dependencies – an Integrated View on Document Annotation

- **Conceptual Document Structure**
  - Can be considered as a kind of ontological skeleton
  - Covers concepts of the document and their relationships
  - Using **implicitely given conceptual structure** requires understanding of document content
  - **Explicitely given conceptual structure** (only a small fraction of entire conceptual structure) can be defined by
    - document author (e.g., index entries, external metadata)
    - document users (e.g., social tagging)
  - The conceptual document structure can also be used for document navigation

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

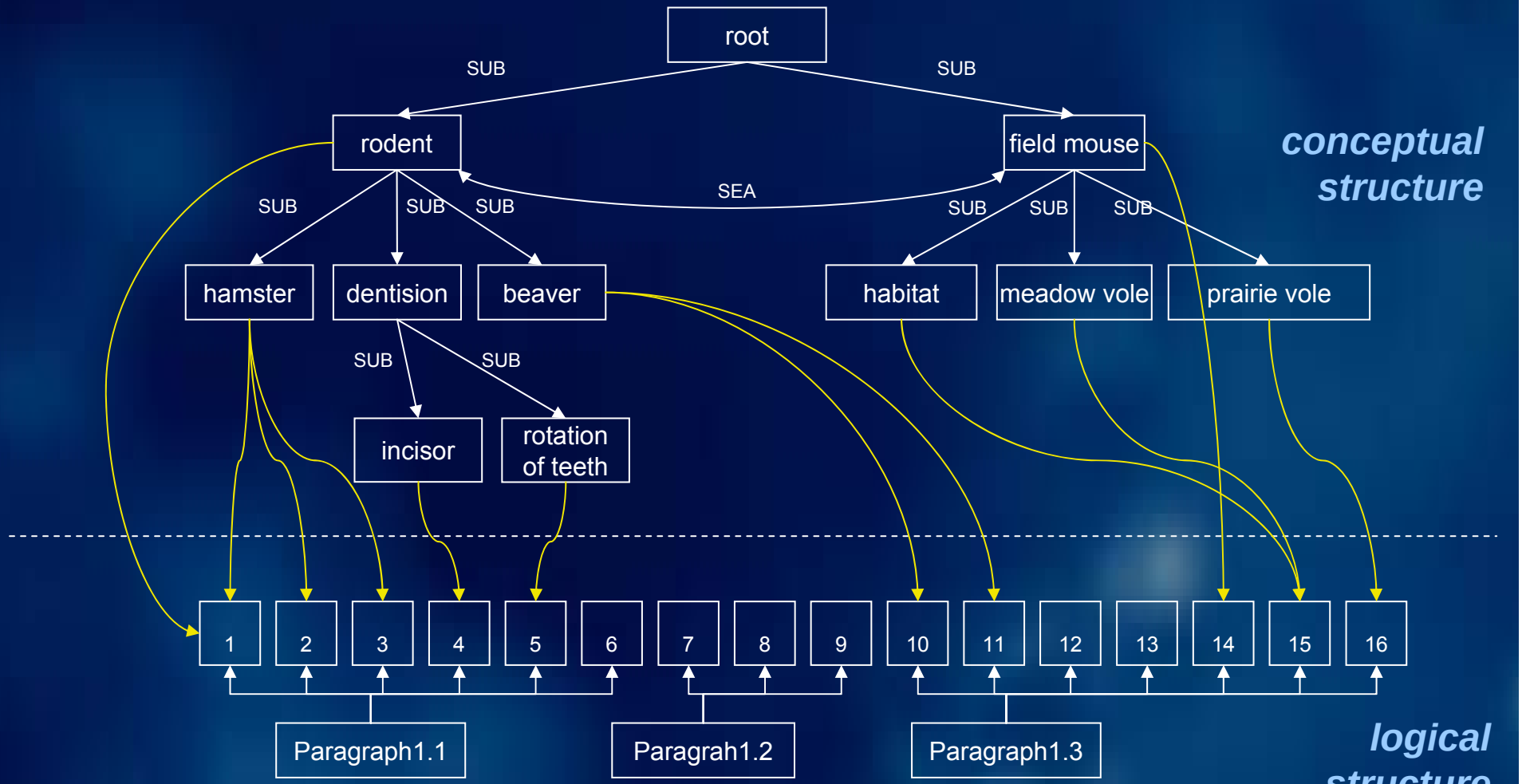
- **Conceptual Document Structure**
  - Using explicitely given conceptual document structure together with logical document structure to define the **document index**



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Conceptual Document Structure**



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Conceptual Document Structure**

rodent, 1
- beaver, 10, 11
- dentision
  - incisor, 4
  - rotation of teeth, 5
- hamster, 2 - 4
- *see also* meadow vole

…

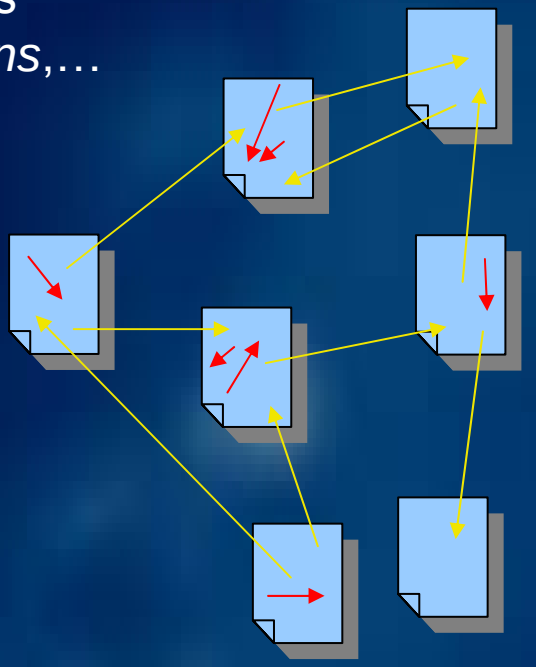
field mouse, 13, 15
- prairie vole, 16
- meadow vole, 16
- habitat, 15
- *see also* rodent

Document Index

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

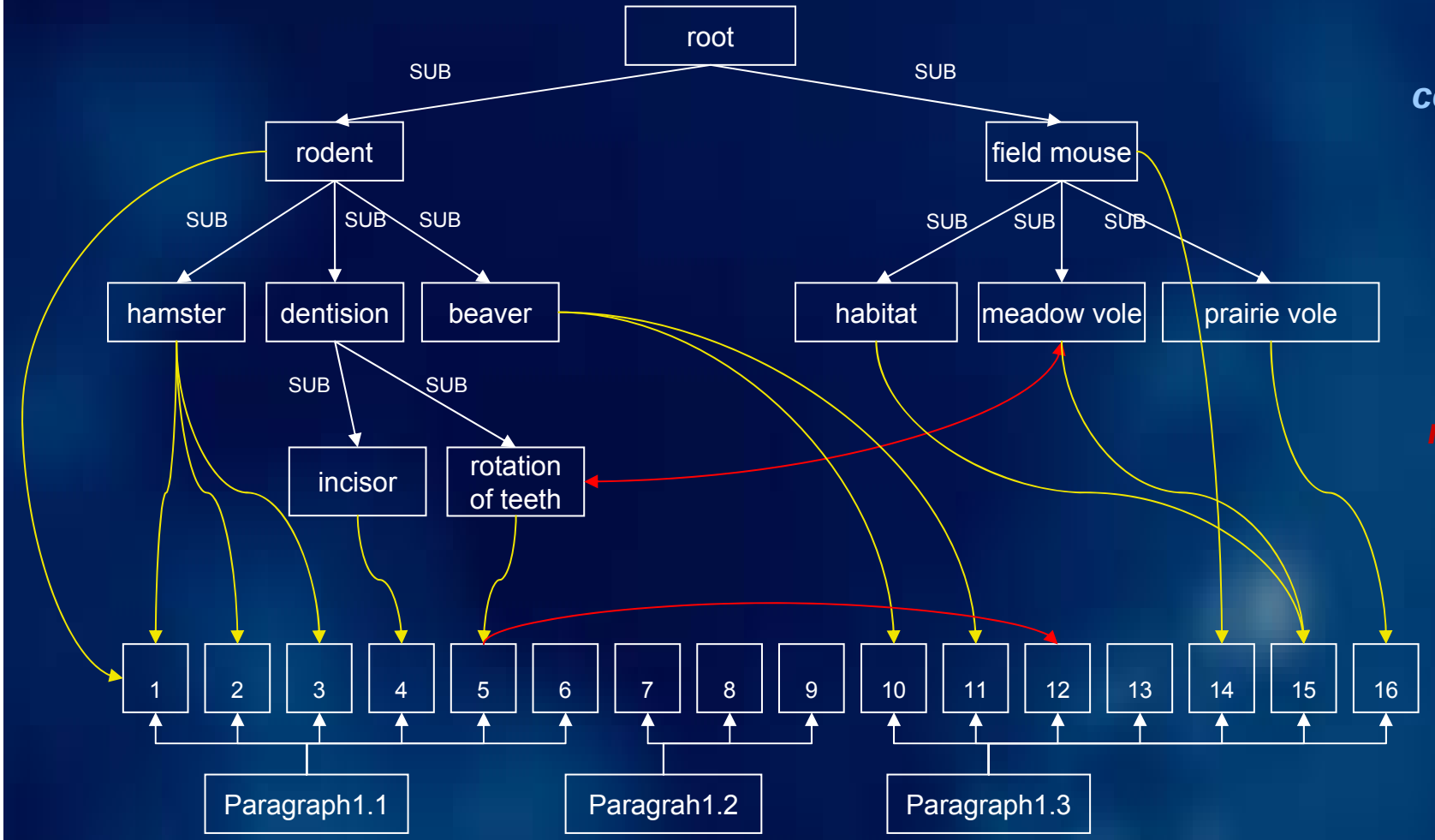
- **Referential Document Structure**
  - **Internal links:**
    References between parts of the same document
    e.g., *see / see also, footnotes, figures, comments…*
  - **External links:**
    References between different documents
    e.g., *bibliographic references and citations*,…
  - Only a fraction of the entire referential document structure is given explicitely
  - Graph Visualization (Link Graph)
  - together with logical document structure
    → table of figure, references, …



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

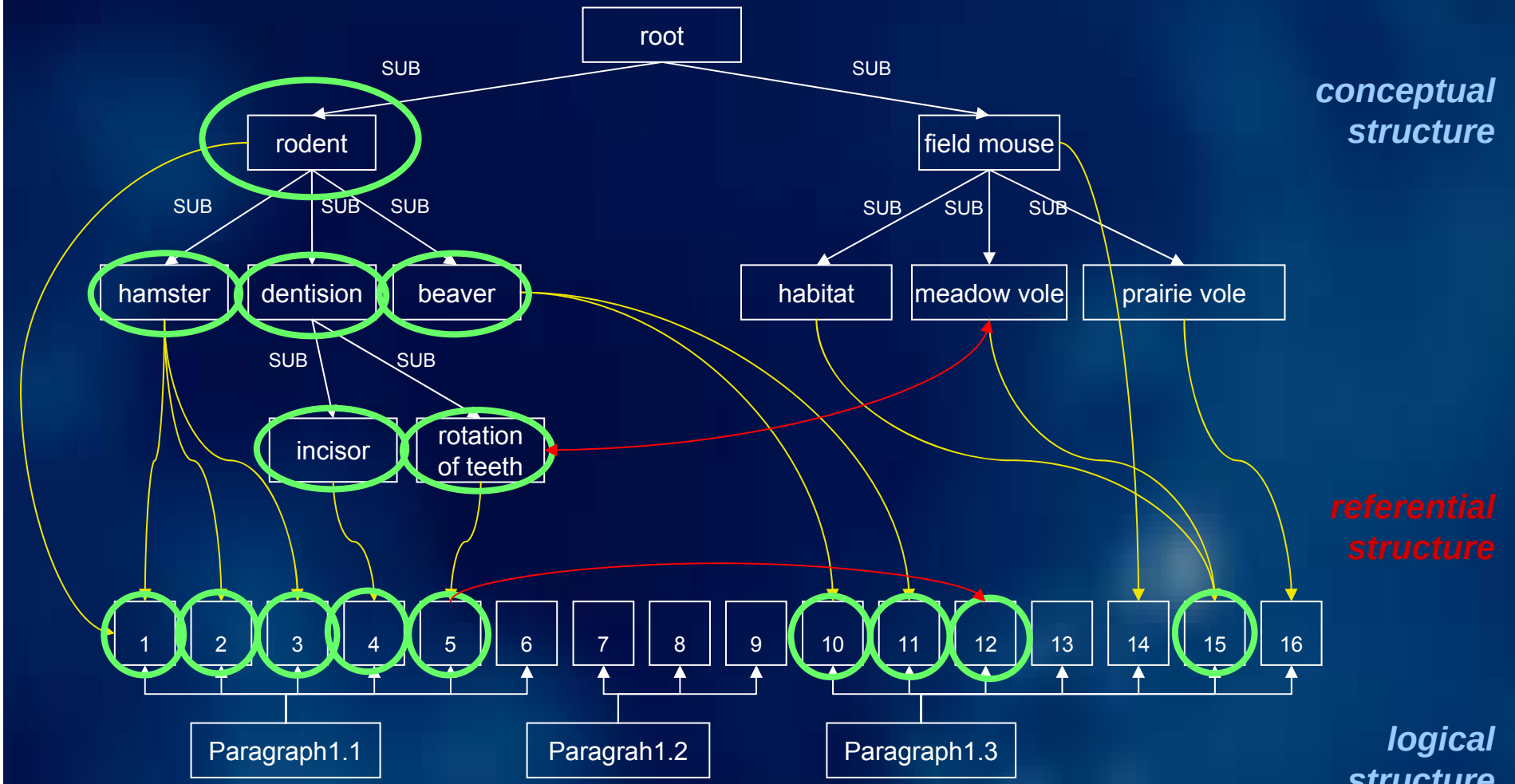
- **The Structures in Concert**



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **The Structures in Concert**



Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **The Structures in Concert**
  - All three structures in concert can be used for
    - **Document reading tours** (extended document retrieval)
      - goal oriented selections of documents (what is mandatory to understand the topic under consideration?)
      - with additional reading directions (which document unit to read in what order)
      - by also considering user annotations, personalized reading tours can be suggested (dependent on prior knowledge of the user)
    - **Collaborative authoring**
      (avoiding ambiguities or duplicates, support index generation and cross referencing,…)
    - **Compute answers…**
      (with the help of sophisticated reasoning and additional means of data mining and content understanding)

Semantic Annotations in Use

Tags and Dependencies – an Integrated View on Document Annotation

- **Conclusion (1)**
  - Documents have intrinsic logical, conceptual and referential characteristics
  - There are complex dependencies among the document structures carrying those characteristics
  - Logical, conceptual, and referential structures along with their interdependencies should be made explicit (→ meta data)
  - Applications should maintain and use those meta data, e.g. for
    - authoring
    - navigation
    - searching

Beckstein, Peter, Sack
OntoLex 2006
XML-Tage 2006
SAAW 2006

Semantic Annotations in Use

Outline

- Tags and Dependencies –
  an Integrated View on Document Annotation
- Osotis –
  Automated and Collaborative Annotation of Multimedia Presentations
- NPBibSearch –
  Ontology Enhance Bibliographic Search

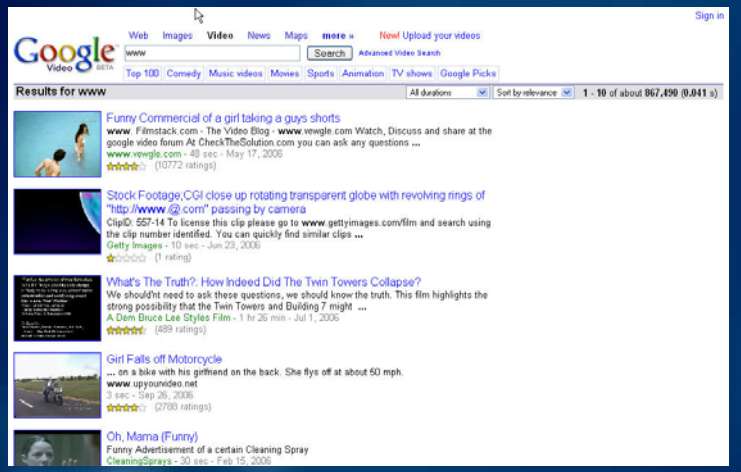
Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Searching Multimedia**
  - keyword based search
  - keyword generation
    - manual
    - Automatic
  - keywords provided by
    - resource author
    - expert
    - non-expert (all others)

↓

collaborative tagging



Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

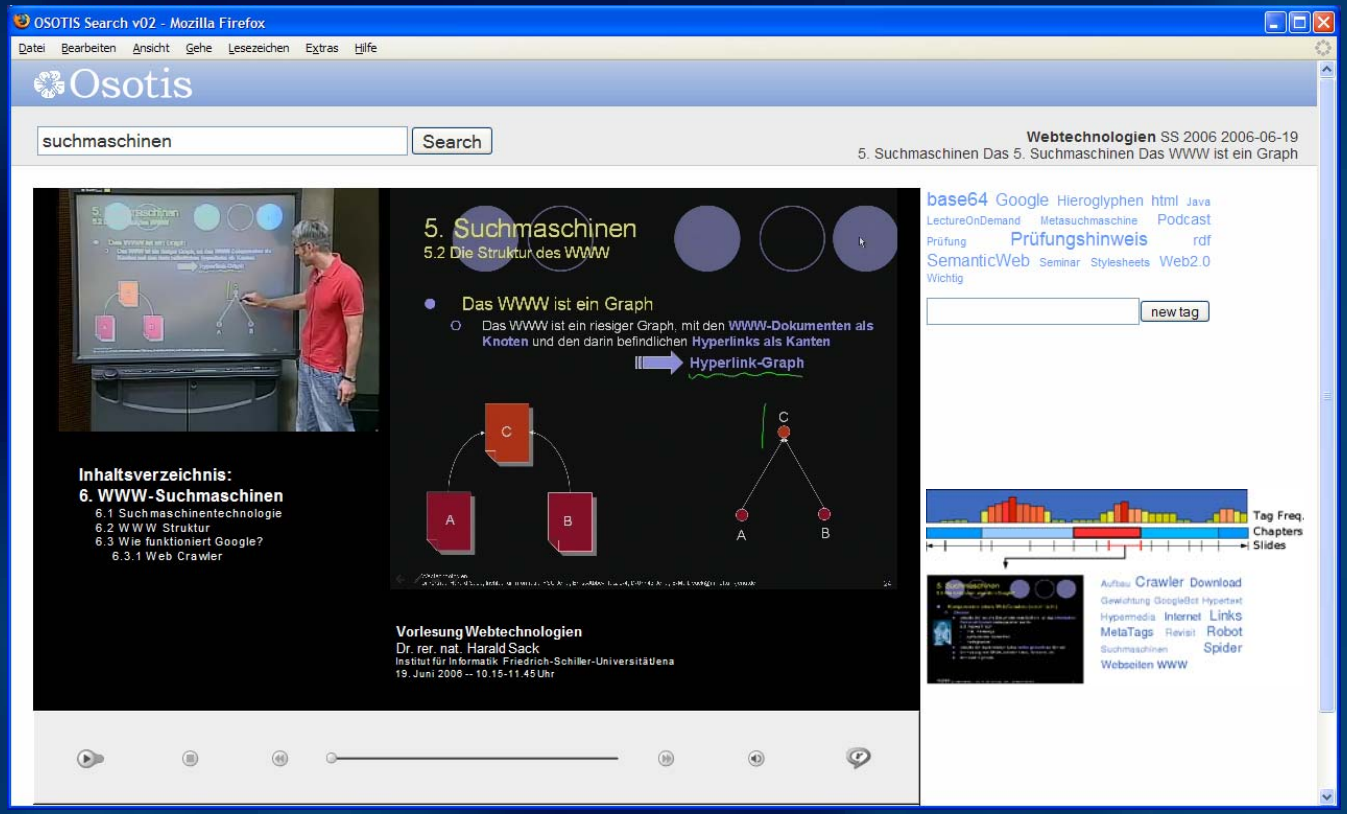
- **Searching Multimedia**
  - keyword stands for entire resource
  - but, what if you are only interested in a small part of the resource ?

e.g. recorded lecture
- duration ~90 minutes
- interesting parts ~5 minutes

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Automated and Collaborative Multimedia Document Annotation**



Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Lecture Recording**
  - **Media-Streaming**
    - synchronized video and desktop recording with navigation
    - encoded with SMIL or MPEG 4

camera **video**

vga capture card **desktop**

interactive table of contents (post processing)

SMIL/MPEG4 encoding

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Lecture Recording and Automated Annotation**
  - **Automatic Scene Detection**
    - cut points
    - changes in perspective
    - motion detection,…
  - **Automatic Feature Extraction**
    - statistical features
    - coloring
    - shape detection
    - lighting,…

(e.g., video recording of a lecture)

➡ **Features vs. Content**

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Lecture Recording and Automated Annotation**
  - **Analysis of Audio Data**
    - speaker independent speech recognition
    - unreliability / errors
    - Determination of context
      - relevance of topics
      - change of topic (start / end)
      - comments / references
      - …

(e.g., video recording of a lecture)

➡ **reliability and accuracy of generated annotation ?!**

➡ **manual annotation ??**

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Manual Annotation of Recorded Lectures**

time line

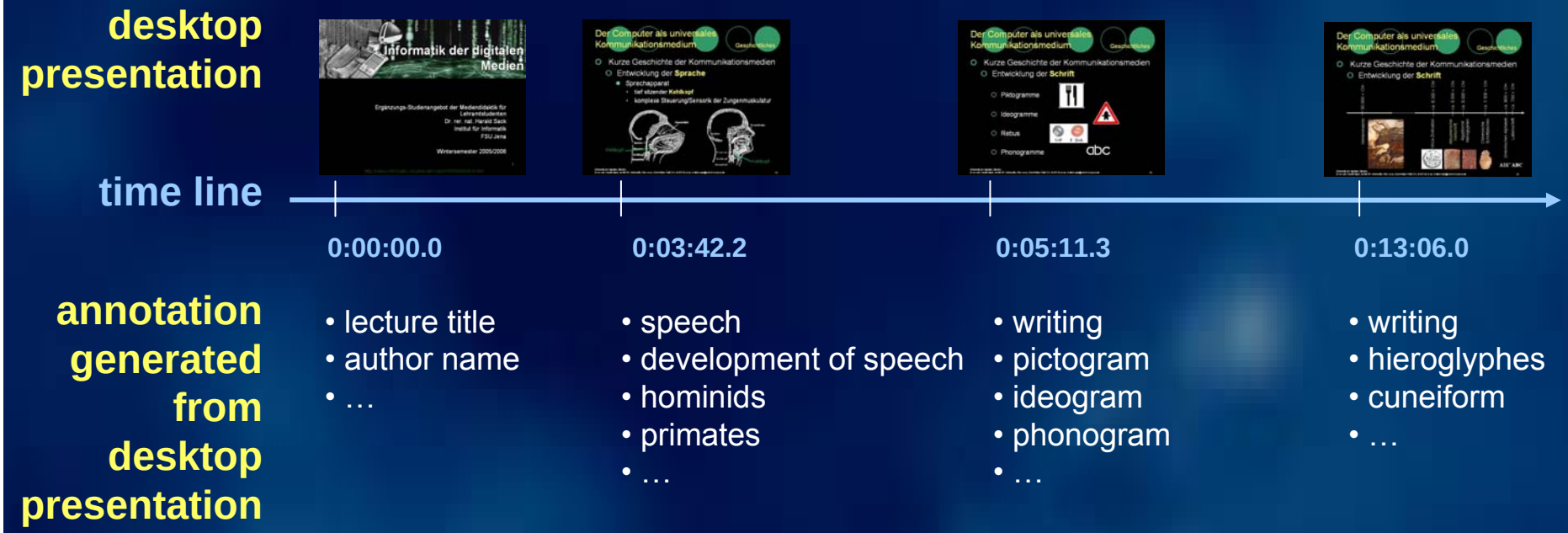
0:00:00.0	0:03:42.2	0:05:11.3	0:13:06.0
user provided annotation			
• welcome address • short repetition of previous lecture	• speech • development of speech • hominids • primates • …	• writing • pictogram • ideogram • phonogram • …	• writing • hieroglyphes • cuneiform • …

MPEG 7 encoded annotation

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

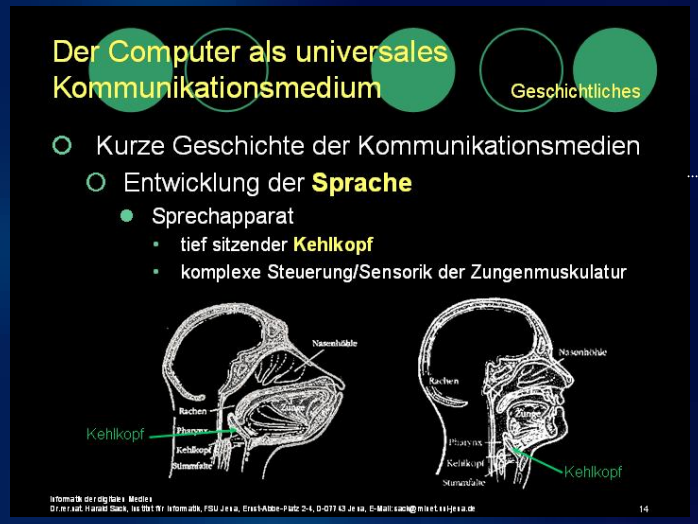
- **Automatic Annotation of Recorded Lectures**
  - use all available resources:
    - video recording, desktop recording, presentation slides, audio recording, …



Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Automatic Annotation of Recorded Lectures**
  - from presentation to annotation



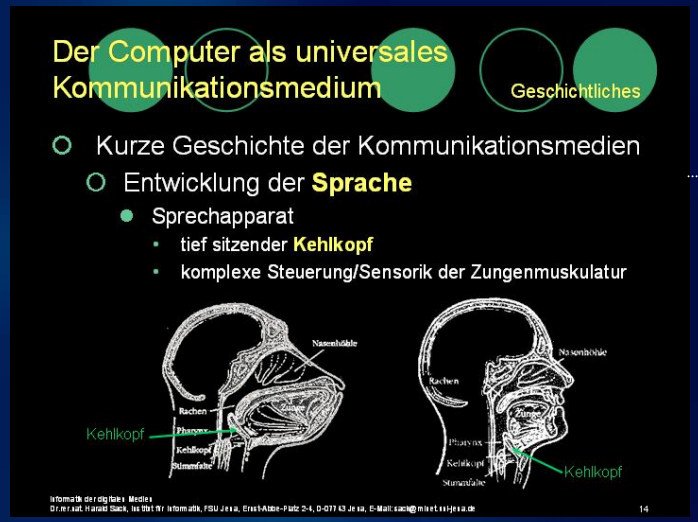
Scene Description

- **Start:** 00:03:42.2
- **End:** 00:05:11.6
- **Title1:** computer as universal communication medium
- **Ebene1:** history of communication medium
- **Ebene2:** developmnent of speech
- **Fett/Farbig:** speech
- **Ebene3:** voice box
- **Ebene4:** larynx
- **Fett/Farbig:** larynx
- …

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Automatic Annotation of Recorded Lectures**
  - from presentation to annotation



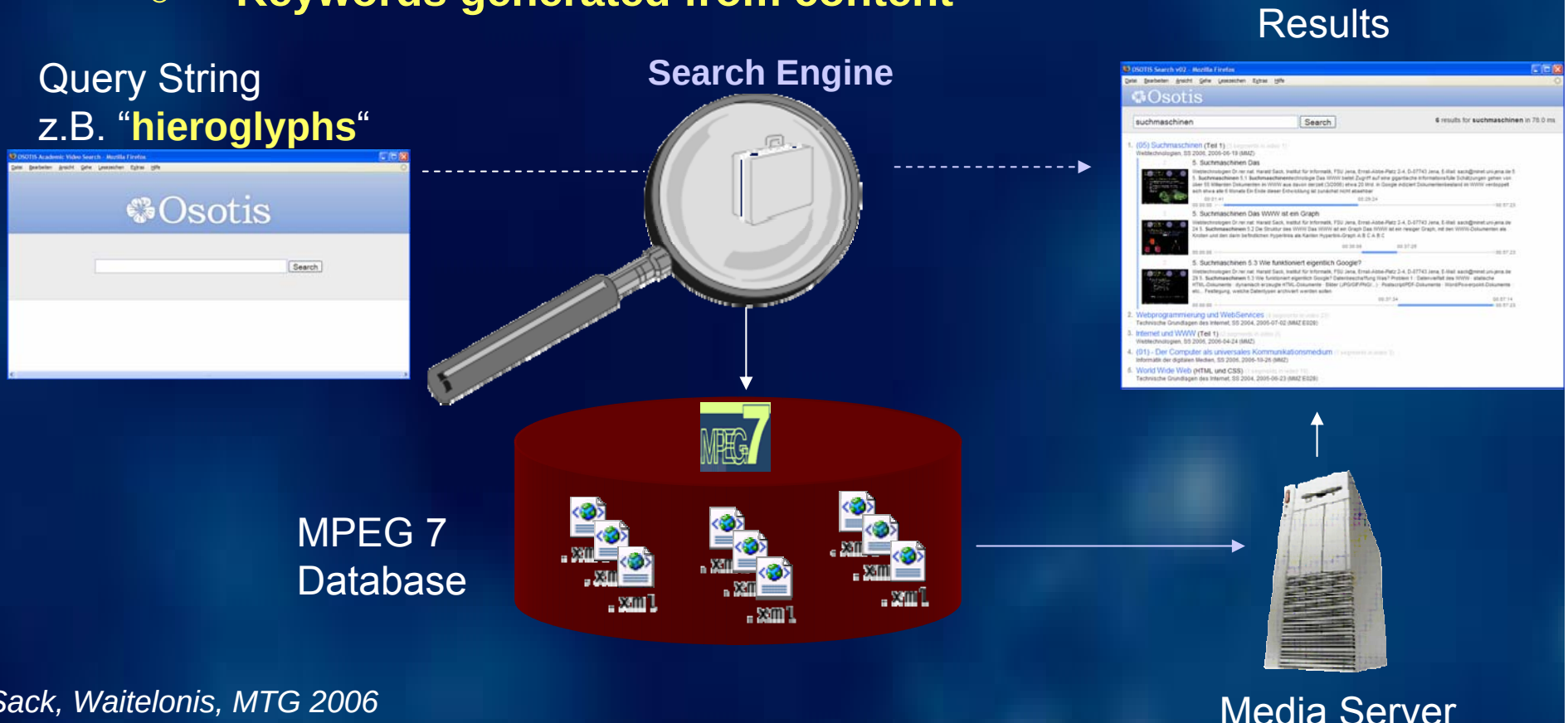

```
<!xml version="1.0" encoding="iso-8859-1">
<Mpeg7 xmlns=urn:mpeg:mpeg7:schema:2001 …>
…
<AudioVisualSegment>
 <TextAnnotation type="heading" xml:lang="de">
  <FreeTextAnnotation> The Computer as Universal
     Communication Medium
  </FreeTextAnnotation>
 </TextAnnotation>
 …..
 <MediaTime>
  <MediaTimePoint> T00:03:42.2 </MediaTimePoint>
  <MediaDuration> PT1M28.6S </MediaDuration>
 </MediaTime>
 ….
```

MPEG7
Scene Description

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Searching Multimedia Lectures**
  - **Keywords generated from content**



Sack, Waitelonis, MTG 2006

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

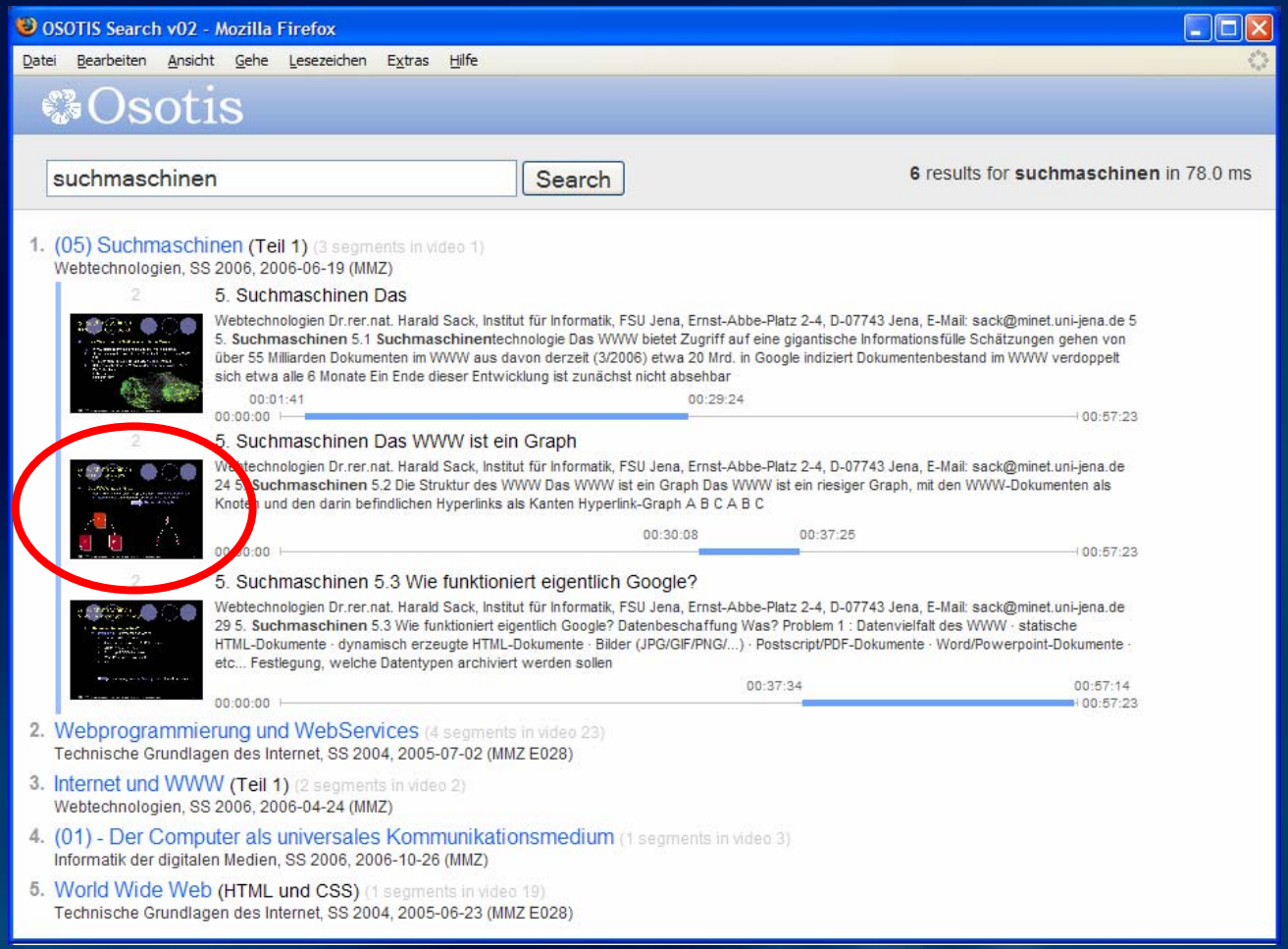
- **Searching Multimedia Lectures**

http://osotis-base1.inf-ra.uni-jena.de:8180/Osotis/

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

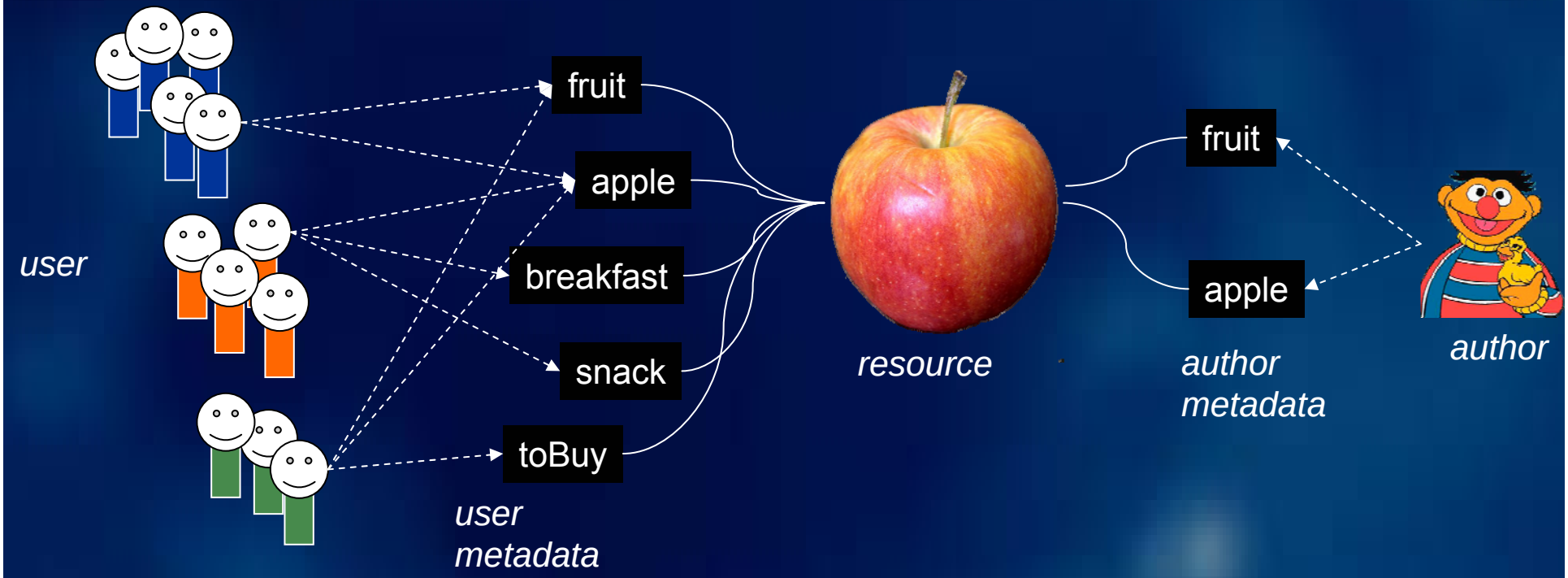
- **Searching Multimedia Lectures**



Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Social Taging Systems**



- keyword based search vs. tag browsing
- social networking

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Integration of Tagging Information into MPEG 7**
  - temporal decomposition of video data
  - annotation of single video segments

```
<Mpeg7 xmlns="...">
 <Description xsi:type="ContentEntityType">
 ...
  <MultimediaContent xsi:type="VideoType">
   <Video>
    <MediaInformation>
    ...
    <TemporalDecomposition>
     <VideoSegment>...</VideoSegment>
     <VideoSegment>...</VideoSegment>
    ...
    </TemporalDecomposition>
   </Video>
  </MultimediaContent>
 </Description>
</Mpeg7>
```

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Integration of Tagging Information into MPEG 7**
  - annotation facilities of MPEG7
    - keyword
    - freetext
    - structure
  - define start / end

Problem:
personalized annotation!

```
<VideoSegment>
 <CreationInformation>...</CreationInformation>
 ...
 <TextAnnotation>
  <KeywordAnnotation>
   <Keyword>cat</Keyword>
   <Keyword>mouse</Keyword>
  </KeywordAnnotation>
  <FreeTextAnnotation>
   billy the cat is catching a mouse
  </FreeTextAnnotation>
 </TextAnnotation>
 <MediaTime>
  <MediaTimePoint>T00:05:05:0F25</MediaTimePoint>
  <MediaDuration>PT00H00M31S0N25F</MediaDuration>
 </MediaTime>
</VideoSegment>
```

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Integration of Tagging Information into MPEG 7**

use MPEG 7 **<MediaReview>-Tag** to encode personalized tagging information

encode tagging information as

({tag set}, user, date, [rating])

```
<CreationInformation>
 <Classification>
  <MediaReview>
   <Rating>
    <RatingValue>9.1</RatingValue>
    <RatingScheme style="higherBetter"/>
   </Rating>
   <FreeTextReview>
    tag1, tag2, tag3
   </FreeTextReview>
   <ReviewReference>
    <CreationInformation>
     <Date>...</Date>
    </CreationInformation>
   </ReviewReference>
   <Reviewer xsi:type="PersonType" >
    <Name>Harald Sack</Name>
   </Reviewer>
  </MediaReview>
  <MediaReview>...</MediaReview>
 </Classification>
</CreationInformation>
```

Semantic Annotations in Use

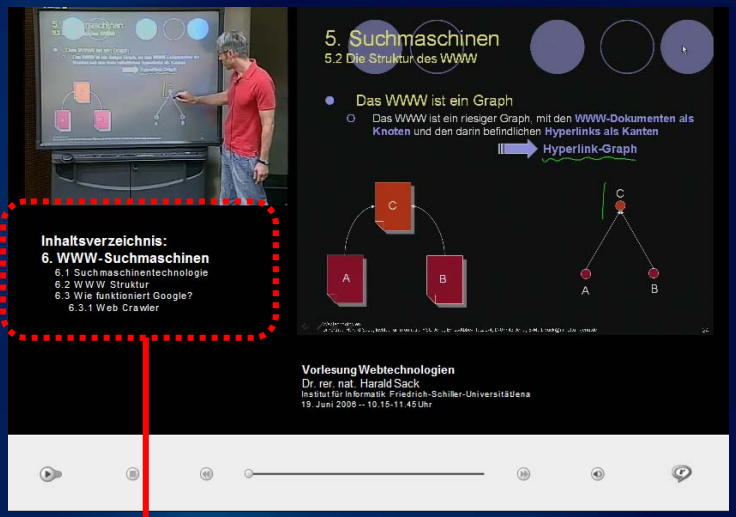
Osotis – Automated and Collaborative Annotation of Multimedia Presentations

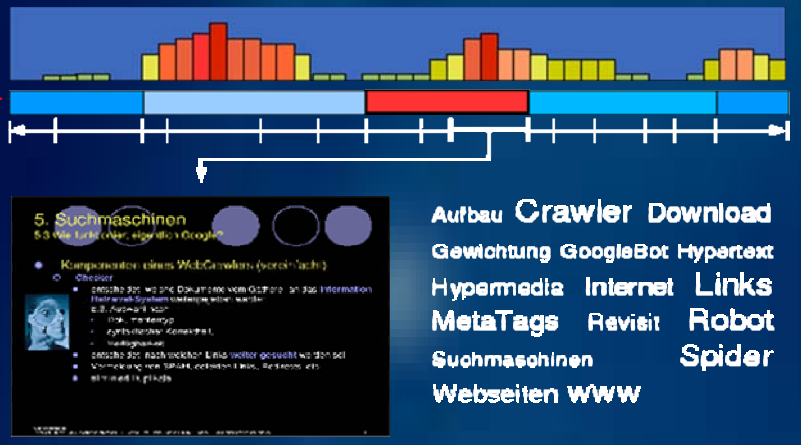
- **Collaborative Lecture Annotation**
  - **Prerequisites**
    - keep user interface as simple as possible (!)
  - **Annotation of entire resource**
    - similar as existing social tagging systems
  - **Annotation of partial resources**
    - one-button solution: pressing button during replay marks **predefined video segment** that can be tagged
    - video segmentation: - each **slide** defines a new video segment (fine)
      - if available, use **table of contents** for segment definition

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

- **Collaborative Lecture Annotation**
  - **Annotation of partial resources**
    - video segmentation: - each **slide** defines a new video segment (fine grain segmentation)
      - if available, use **table of contents** for segment definition





segments defined by TOC

Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations

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  - **Annotation of partial resources**
    - video segmentation: - each **slide** defines a new video segment (fine grain segmentation)
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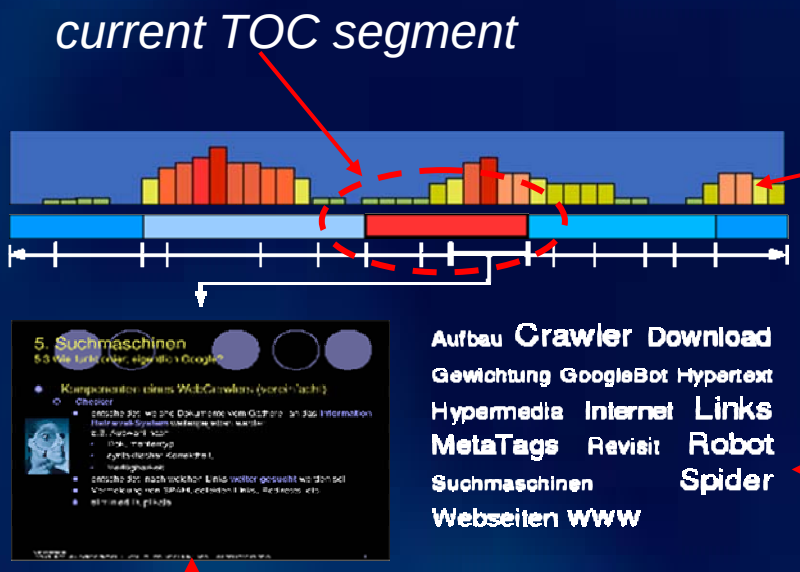
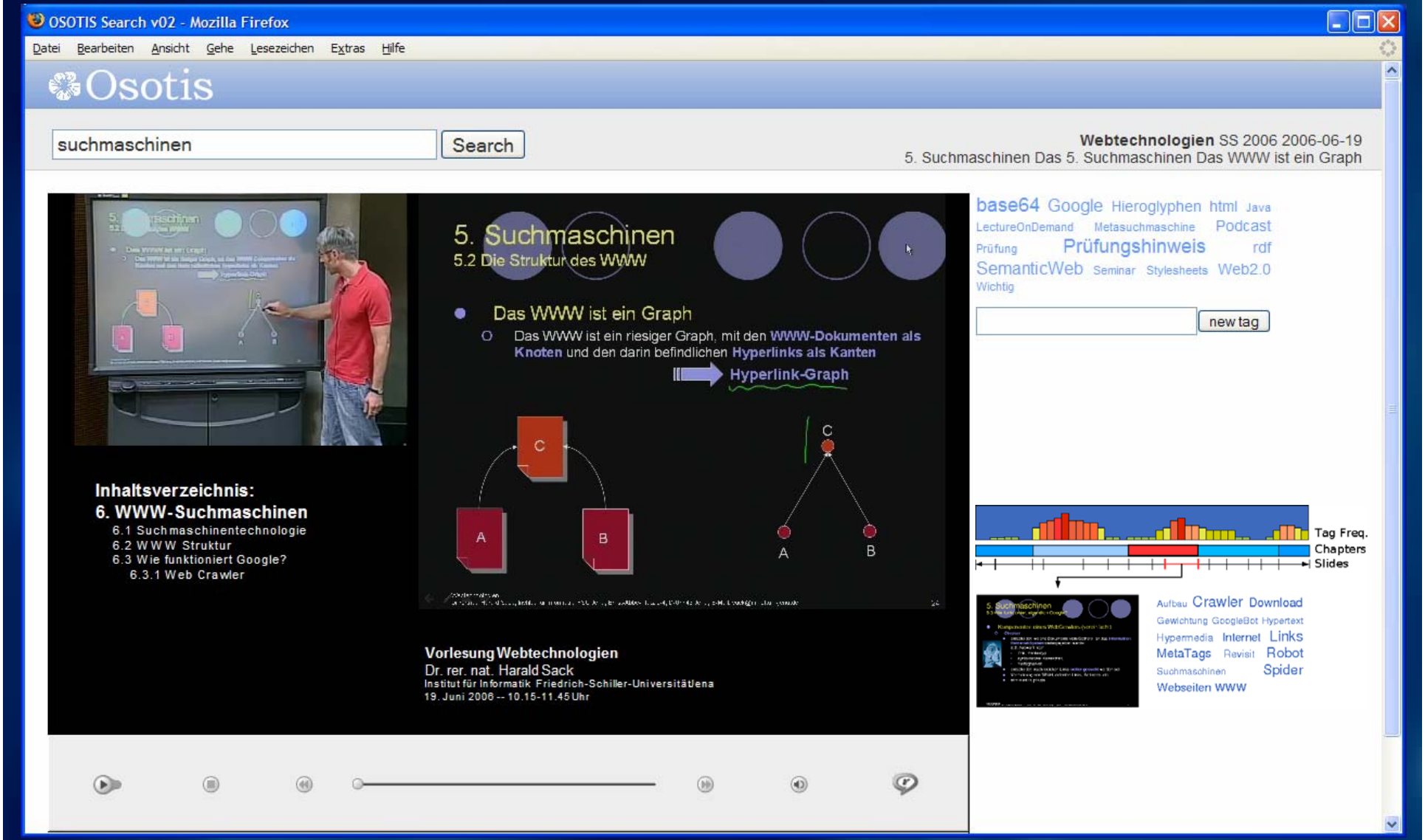


Semantic Annotations in Use

Osotis – Automated and Collaborative Annotation of Multimedia Presentations



Future Work

- Extension for general (**time dependent**) media tagging based on MPEG7
  - automatic segmentation by
    - scene detection, scene analysis, object trace,…
    - audio analysis

- Extension for general partial document tagging (**time independent media**)
  - only difference to conventional tagging systems is identification and adressing of single document parts
  - identification and addressing of partial documents can be achieved with **XPointer / XPath** expressions

Sack, Waitelonis
MTG 2006 (ESWC)
SAAW2006 (ISWC)

Semantic Annotations in Use

Outline

- Tags and Dependencies –
  an Integrated View on Document Annotation
- Osotis –
  Automated and Collaborative Annotation of Multimedia Presentations
- NPBibSearch –
  Ontology Enhance Bibliographic Search

Bibliographic Search

- **Bibliography** (*greek: description of books*)
  The study of books.
  It can be divided into **enumerative** or **systematic** bibliography, which results in an overview of publications in a particular category, and **analytical** or **critical** bibliography, which studies the production of books.

  - A bibliography is a list of publications
    - by a particular author / on a particular subject
    - published in a particular country / in a specified period
    - mentioned in, or relevant to a particular publication

Bibliographic Search

- Simple bibliographic search
  - Search by author, title, publisher, year, …
  - Search by keywords
- More complex bibliographic search
  - Search for **cross references**
  - Search for same / **similar topics**
  - Search for **related work**

requires knowledge of the represented domain

Bibliographic Search

- **Bibliographies in the WWW (*computer science related*)**
  - The Collection of Computer Science Bibliographies, Karlsruhe
  - Scientific Literature Digital Library – CiteSeer.IST
  - Digital Bibliography and Library Project - DBLP
  - …
  - *Electronic Colloquium of Computational Complexity (ECCC)*
- (normally) provide simple bibliographic searches
  - additional (limited) cross referencing
  - (limited) search for similar publications

Bibliographic Search

- **with general search engines**
  - via search restrictions (e.g. domain name, filetype,…)
  - → *query string must be part of document*
- **with bibliographic databases *(specialized search engines)***
  - **not moderated**
    - author provides semantic information
    - → *keyword ambiguities, different spellings, etc.*
  - **moderated**
    - Editor provides semantic information → unique keywords
    - → *user must be aware of keyword usage*

Search based on keywords only narrows recall

Improving Web Search with Ontologies

- **Semantic Web Search**
  - Annotate web documents with semantic information (*semantic web*)
- **Standard Web Search Augmented by Semantic Information**
  - As long as there are not enough metadata available
    → use semantic information to supplement standard web search
- **How To ?**
  1. Query string evaluation
  2. Query string expansion
  3. Domain navigation and cross referencing
  4. Provide supplementary information

Improving Web Search with Ontologies

(1) Query string evaluation

- **To Do**: Assignment of appropriate category for query string evaluation
- **Problem**: User has to guess the “right“ keyword according to her/his information needs

- Ontologies can
  - provide synonyms
  - distinguish homonyms
  - find appropriate category (e.g. via hypernyms)

e.g. Query string: ‘satisfiability‘ → search also for ‘SAT‘

Improving Web Search with Ontologies

(2) Query string expansion

- **To Do**: Expand or narrow scope of current search
- **Problem**: Knowledge about the search domain necessary

- Ontologies can provide synonyms, acronyms, alternative spellings, or related terms
  - to **expand** search scope ('*OR*')
  - to **narrow** search scope ('*AND*')

e.g. Query string: 'satisfiability' → append 'decision problem'

Improving Web Search with Ontologies

(3) Domain navigation and cross-referencing

- **To Do**: Help the user to find the information he is looking for
- **Problem**: Knowledge about the search domain necessary

- Ontologies provide
  - Taxonomies of the search domain
  - Relationships between domain elements and/or domain entities

e.g. ‘satisfiability‘ → is generalization of ‘3-SAT‘ OR ‘CNF-SAT‘
→ can be reduced to ‘3-SAT‘

Improving Web Search with Ontologies

(4) Additional information

- **To Do**: Provide further information referring to particular search results
- **Problem**: User has to know, how/where to look up

- Ontologies can help
  - to classify search result and thus,
  - to find further information

e.g. for bibliographic search find related information about authors or about search topic

NPBibSearch – the Basics

- **NP-complete decision problems**

NP

Decision problems solvable in **polynomial time** on a **non-deterministic turing machine**.

NP-complete

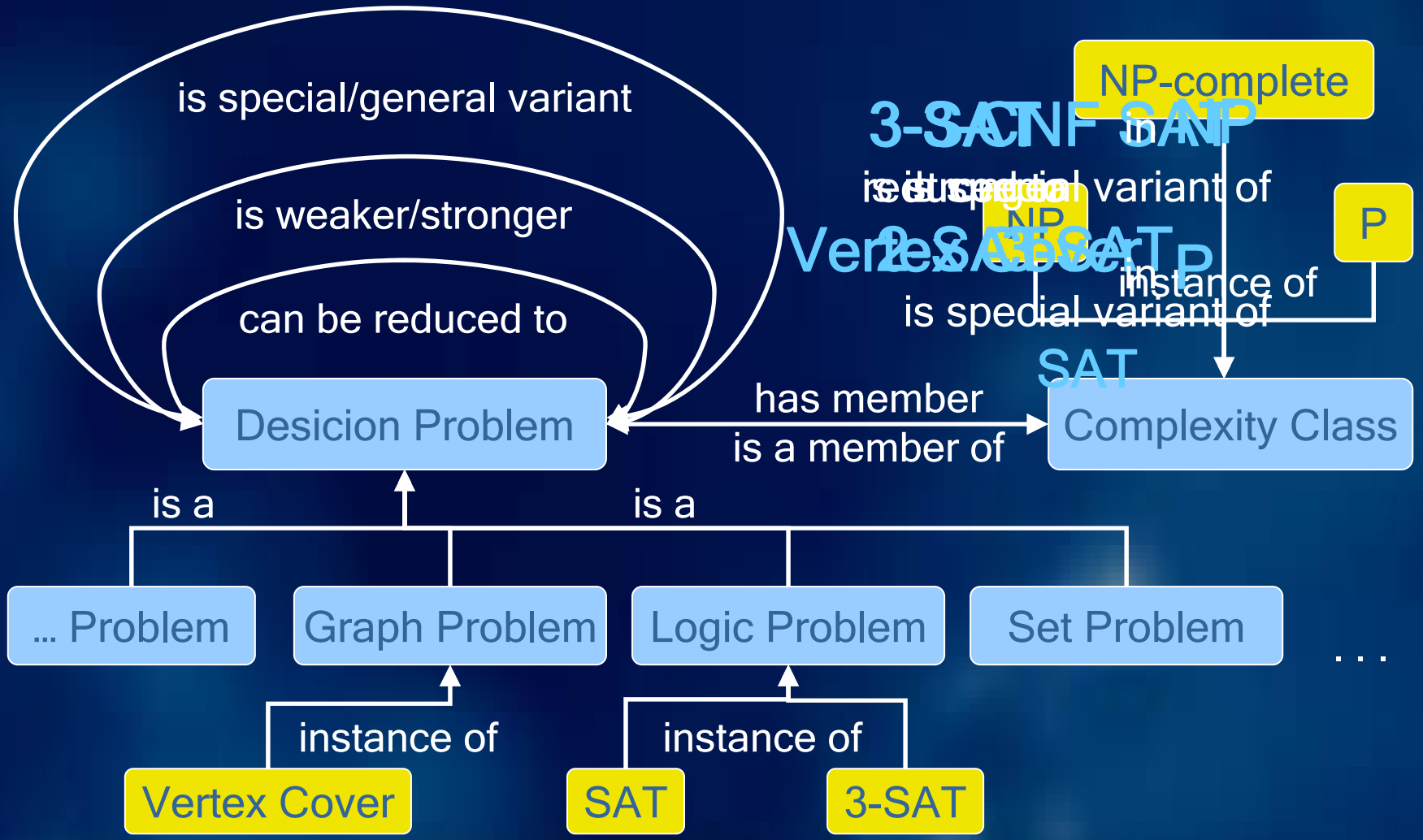
Decision problems in NP
Every other decision problem in NP can be **reduced** to an NP-complete problem in **polynomial time**

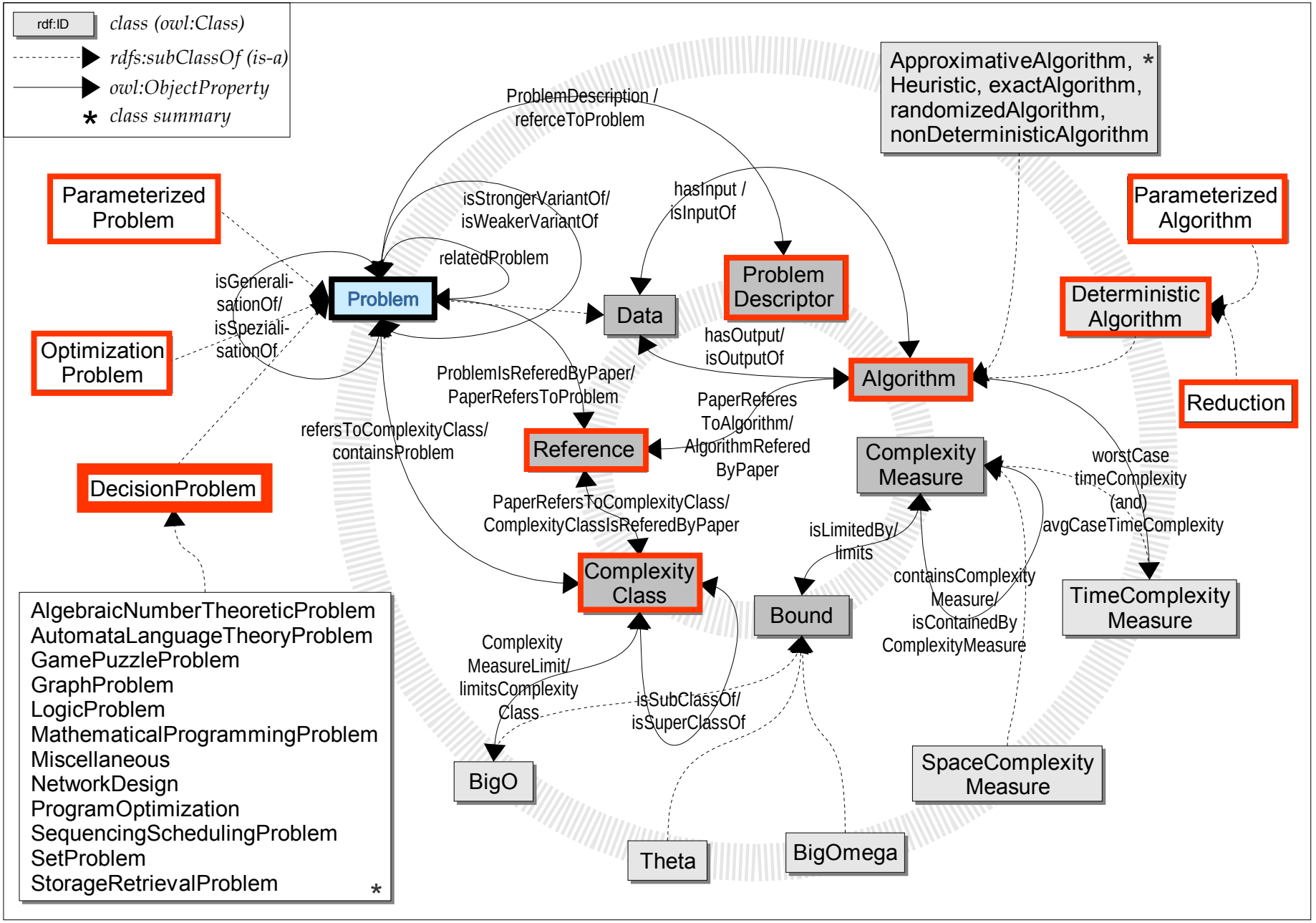
e.g. **SAT**: Given a Boolean formula, is there any satisfying truth assignment?

Semantic Annotations in Use

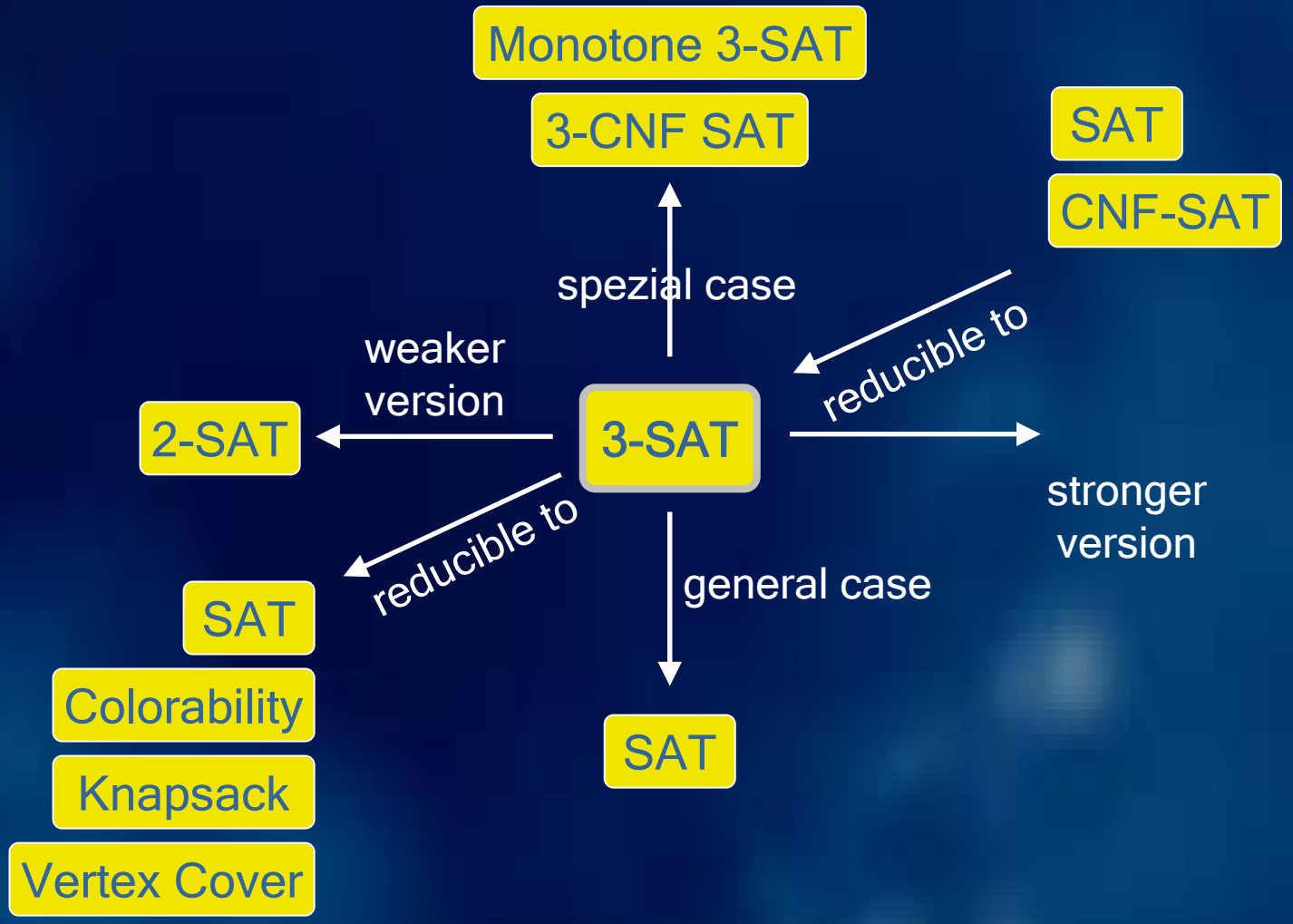
NPBibSearch - An Ontology Enhanced Bibliographic Search

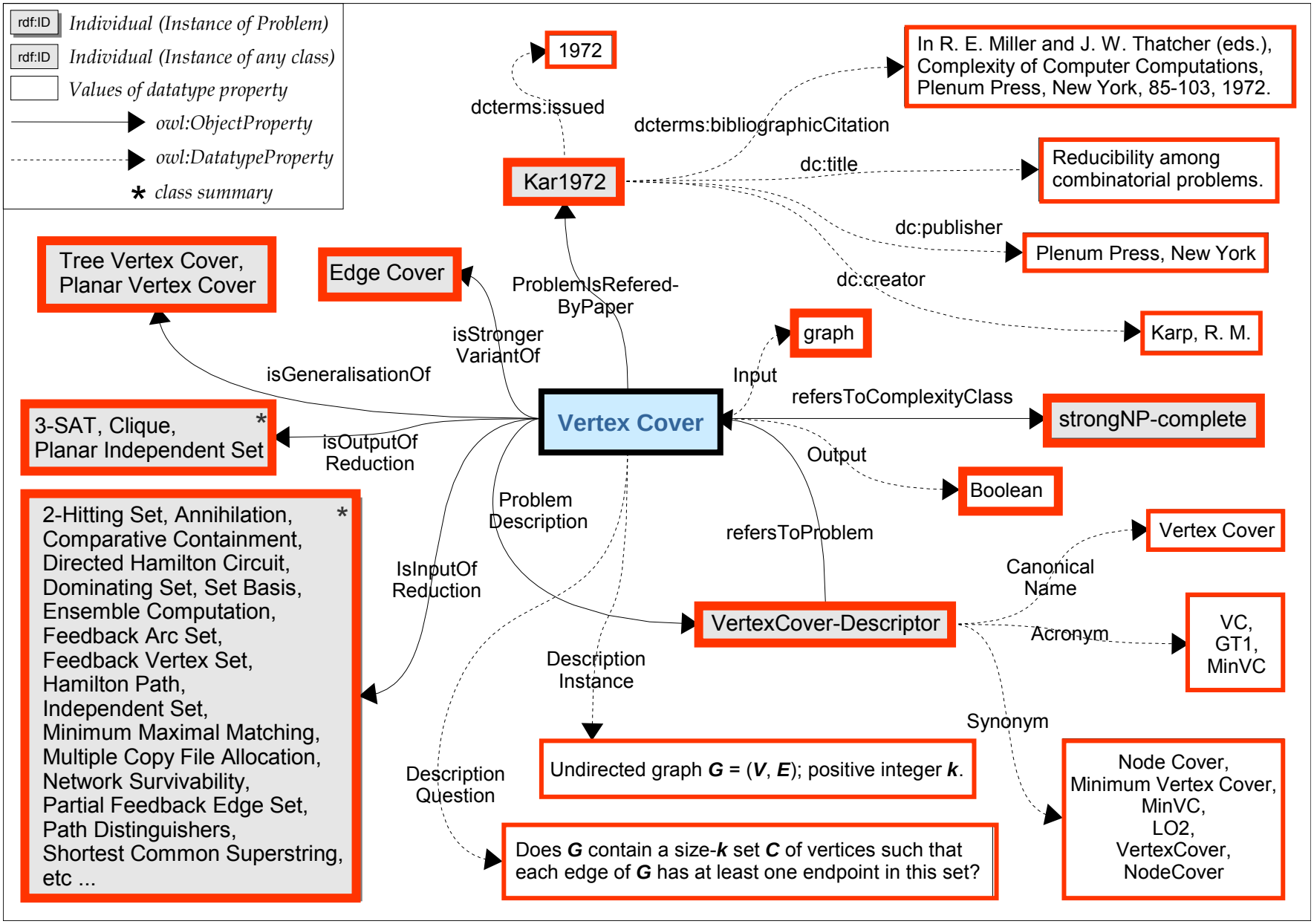
NP Ontology (simplified)




rdf:ID
class (owl:Class)
rdfs:subClassOf (is-a)
owl:ObjectProperty
* class summary
ApproximativeAlgorithm, *
Heuristic, exactAlgorithm,
randomizedAlgorithm,
nonDeterministicAlgorithm
ProblemDescription /
referceToProblem
Parameterized
Problem
isStrongerVariantOf/
isWeakerVariantOf
hasInput /
isInputOf
Parameterized
Algorithm
relatedProblem
Problem
Data
Problem
Descriptor
Deterministic
Algorithm
isGenerali-
sationOf/
isSpeziali-
sationOf
Optimization
Problem
hasOutput/
isOutputOf
Algorithm
Reduction
ProblemIsReferedByPaper/
PaperRefersToProblem
PaperReferes
ToAlgorithm/
AlgorithmRefered
ByPaper
refersToComplexityClass/
containsProblem
Reference
Complexity
Measure
worstCase
timeComplexity
(and)
avgCaseTimeComplexity
DecisionProblem
PaperRefersToComplexityClass/
ComplexityClassIsReferedByPaper
isLimitedBy/
limits
Complexity
Class
Bound
containsComplexity
Measure/
isContainedBy
ComplexityMeasure
TimeComplexity
Measure
AlgebraicNumberTheoreticProblem
AutomataLanguageTheoryProblem
GamePuzzleProblem
GraphProblem
LogicProblem
MathematicalProgrammingProblem
Miscellaneous
NetworkDesign
ProgramOptimization
SequencingSchedulingProblem
SetProblem
StorageRetrievalProblem
*
Complexity
MeasureLimit/
limitsComplexity
Class
isSubClassOf/
isSuperClassOf
BigO
SpaceComplexity
Measure
Theta
BigOmega

NP Ontology (simplified)




rdf:ID Individual (Instance of Problem)
rdf:ID Individual (Instance of any class)
Values of datatype property
owl:ObjectProperty
owl:DatatypeProperty
* class summary
1972
dcterms:issued
In R. E. Miller and J. W. Thatcher (eds.), Complexity of Computer Computations, Plenum Press, New York, 85-103, 1972.
dcterms:bibliographicCitation
Kar1972
dc:title
Reducibility among combinatorial problems.
dc:publisher
Plenum Press, New York
dc:creator
Karp, R. M.
Tree Vertex Cover, Planar Vertex Cover
Edge Cover
ProblemIsRefered-ByPaper
isStronger VariantOf
graph
isGeneralisationOf
Input
refersToComplexityClass
strongNP-complete
3-SAT, Clique, Planar Independent Set *
isOutputOf Reduction
Vertex Cover
Output
Boolean
Problem Description
refersToProblem
Vertex Cover
Canonical Name
2-Hitting Set, Annihilation, Comparative Containment, Directed Hamilton Circuit, Dominating Set, Set Basis, Ensemble Computation, Feedback Arc Set, Feedback Vertex Set, Hamilton Path, Independent Set, Minimum Maximal Matching, Multiple Copy File Allocation, Network Survivability, Partial Feedback Edge Set, Path Distinguishers, Shortest Common Superstring, etc ... *
IsInputOf Reduction
VertexCover-Descriptor
Acronym
VC, GT1, MinVC
Description Instance
Synonym
Undirected graph G = (V, E); positive integer k.
Node Cover, Minimum Vertex Cover, MinVC, LO2, VertexCover, NodeCover
Description Question
Does G contain a size-k set C of vertices such that each edge of G has at least one endpoint in this set?

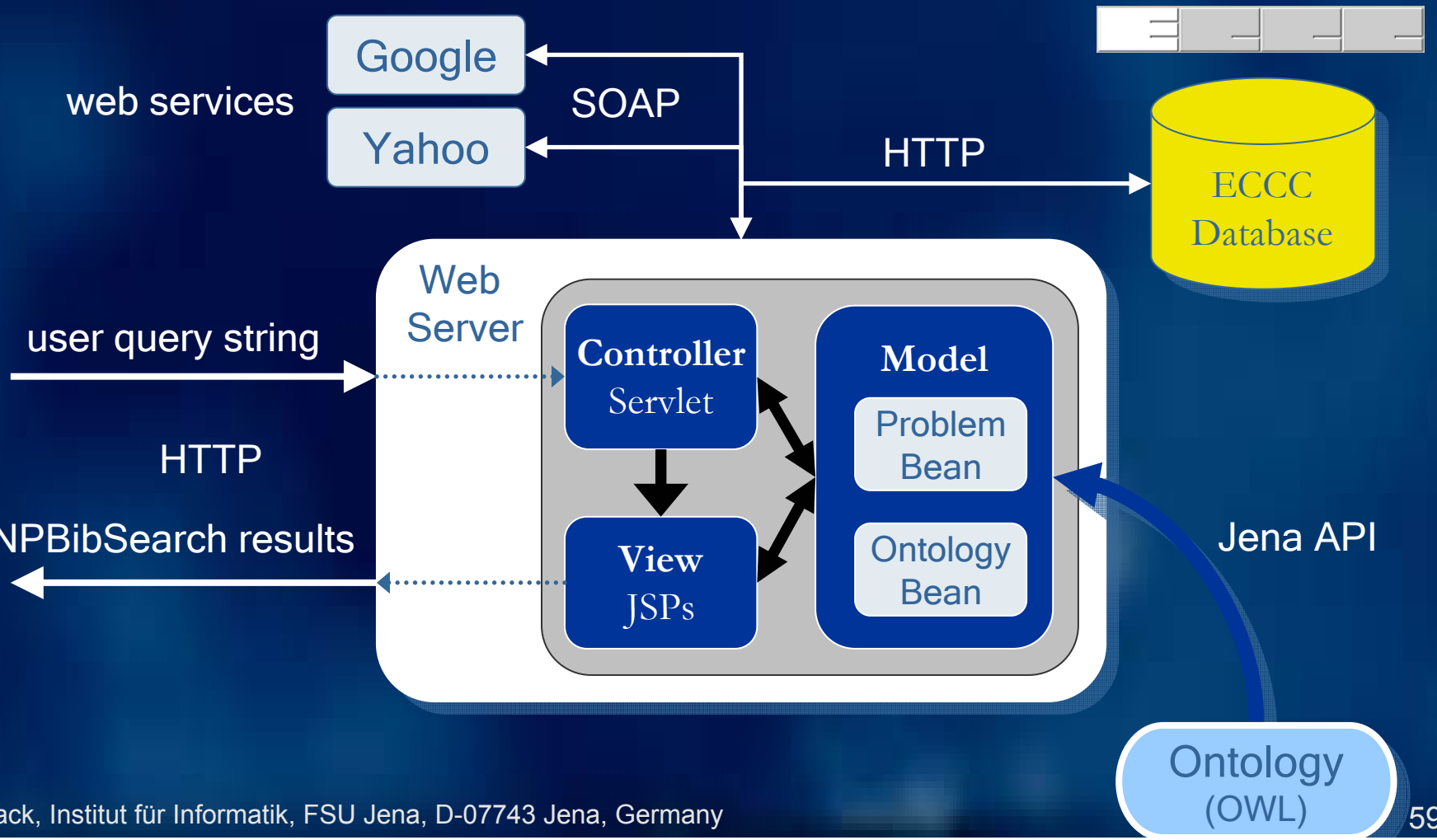
NPBibSearch – the Implementation

- **Bibliographic search** inside a restricted domain:
  - NP-complete decision problems
    - Use **ontology on NP-complete decision problems**
  - Bibliography of a particular digital library
    - **ECCC** (Electronic Colloquium on Computational Complexity)
- Index provided by **Google** for full text search
  - restrict filetype to publications (ps/pdf)
  - restrict search domain to ECCC
  -
- Additional information
  - Specialized search engine → CiteSeer.IST
  - Bibliographic database → DBLP

Semantic Annotations in Use

NPBibSearch - An Ontology Enhanced Bibliographic Search

NPBibSearch – the Implementation



NP BibSearch

Yahoo
Google

Search

3-sat

You can choose synonyms to expand your search:

☐ LO2 ☐ 3-CNF-SAT ☐ 3 SAT ☐ 3SATISFIABILITY
☑ 3-SAT ☐ 3SAT ☐ 3-SATISFIABILITY

hide synonyms

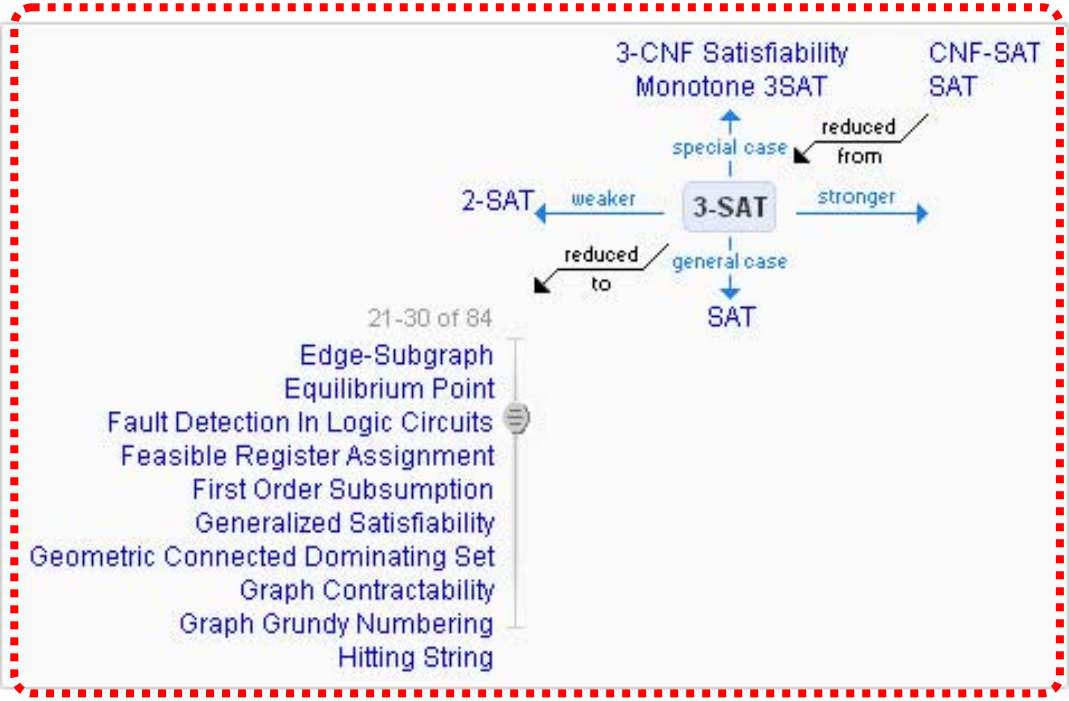
3-SAT

Instance: Set U of variables, collection C of clauses over U such that each clause $c \in C$ has $|c|=3$.

Question: Is there a satisfying truth assignment for C?

Reference: [Coo1971a]

Cook, S. A., *The Complexity of Theorem-Proving Procedures*, Proc. 3rd Ann. ACM Symp. on Theory of Computing, Association for Computing Machinery, New York, 151-158, 1971.



ECCC (Google) Results **1-10** of about **50** from **ecccc.hpi-web.de** for **3-sat**.

around the document | keywords | third party links

1. **ECCC Report TR03-053**, accepted on Jul 08, 2003 | BibTeX
   Kazuo Iwama Suguru Tamaki
   Improved Upper Bounds for 3-SAT (PS | PDF)
   This paper presents a new upper bound for the k-satisfiability problem. For small k´s, especially for k=3, there have been a lot of algorithms which run significantly faster than the trivial 2^n bound. The following list summarizes those algorithms w... + more
   (Google snippet)
   keywords: CNF Satisfiability, Probabilistic Algorithm, Complexity,
   third party links: CiteSeer | dblp over Google | CSBC

2. **ECCC Report TR03-007**, accepted on Jan 28, 2003 | BibTeX
   Olivier Dubois Yacine Boufkhad Jacques Mandler
   Typical random 3-SAT formulae and the satisfiability threshold (PS | PDF)
   k-SAT is one of the best known among a wide class of random constraint satisfaction problems believed to exhibit a threshold phenomenon where the control parameter is the ratio, number of constraints to number of variables. There has been a large amo... + more (Google snippet)
   keywords: satisfiability, random 3-SAT, threshold phenomena, phase transitions,
   third party links: CiteSeer | dblp over Google | CSBC

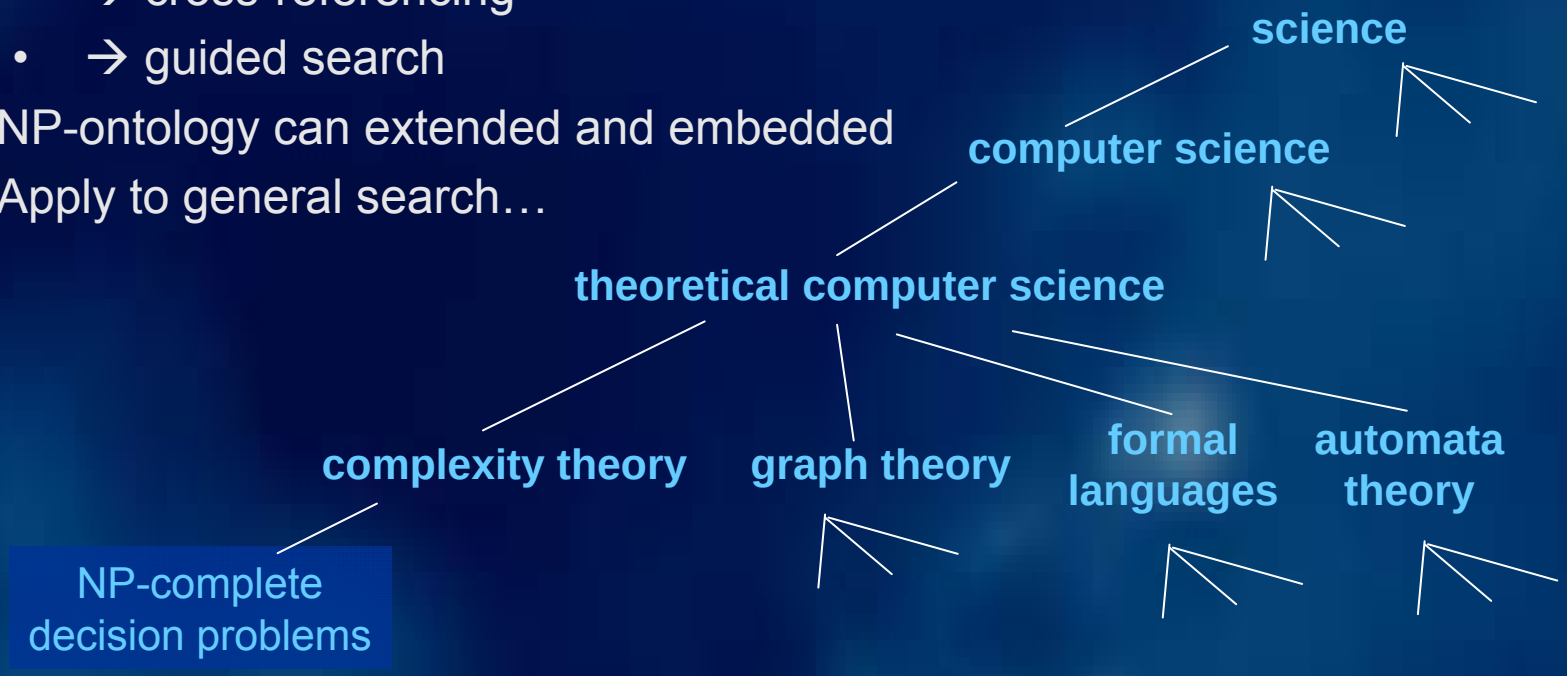
Semantic Annotations in Use

NPBibSearch - An Ontology Enhanced Bibliographic Search

Sack, Krüger
SWAP2005
XML-Tage 2006

Conclusions (3)

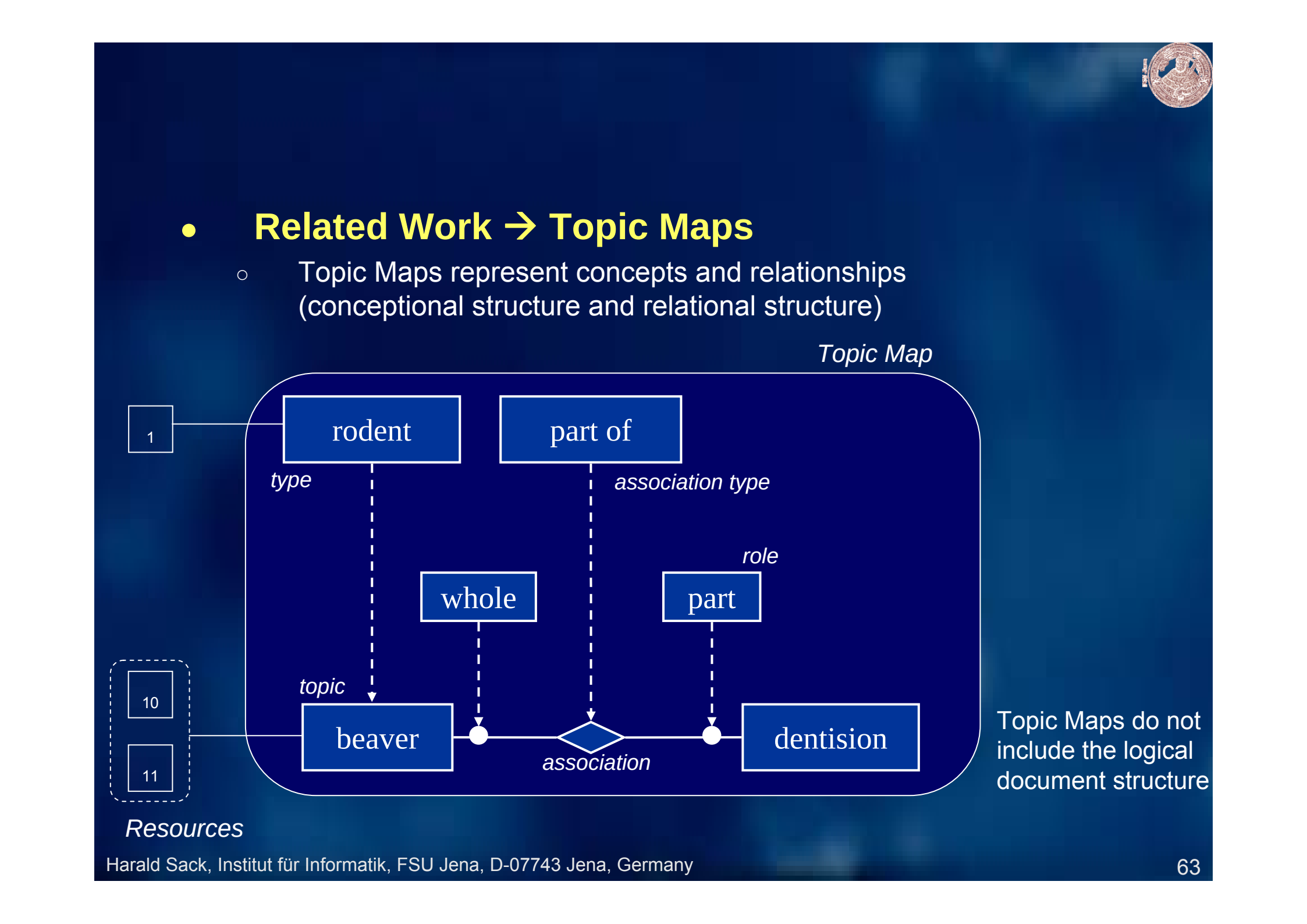
- NPBibSearch offers improved bibliographic search in a restricted domain
  - → domain navigation
  - → cross-referencing
  - → guided search
- NP-ontology can extended and embedded
- Apply to general search…



Semantic Annotations in Use

Outline

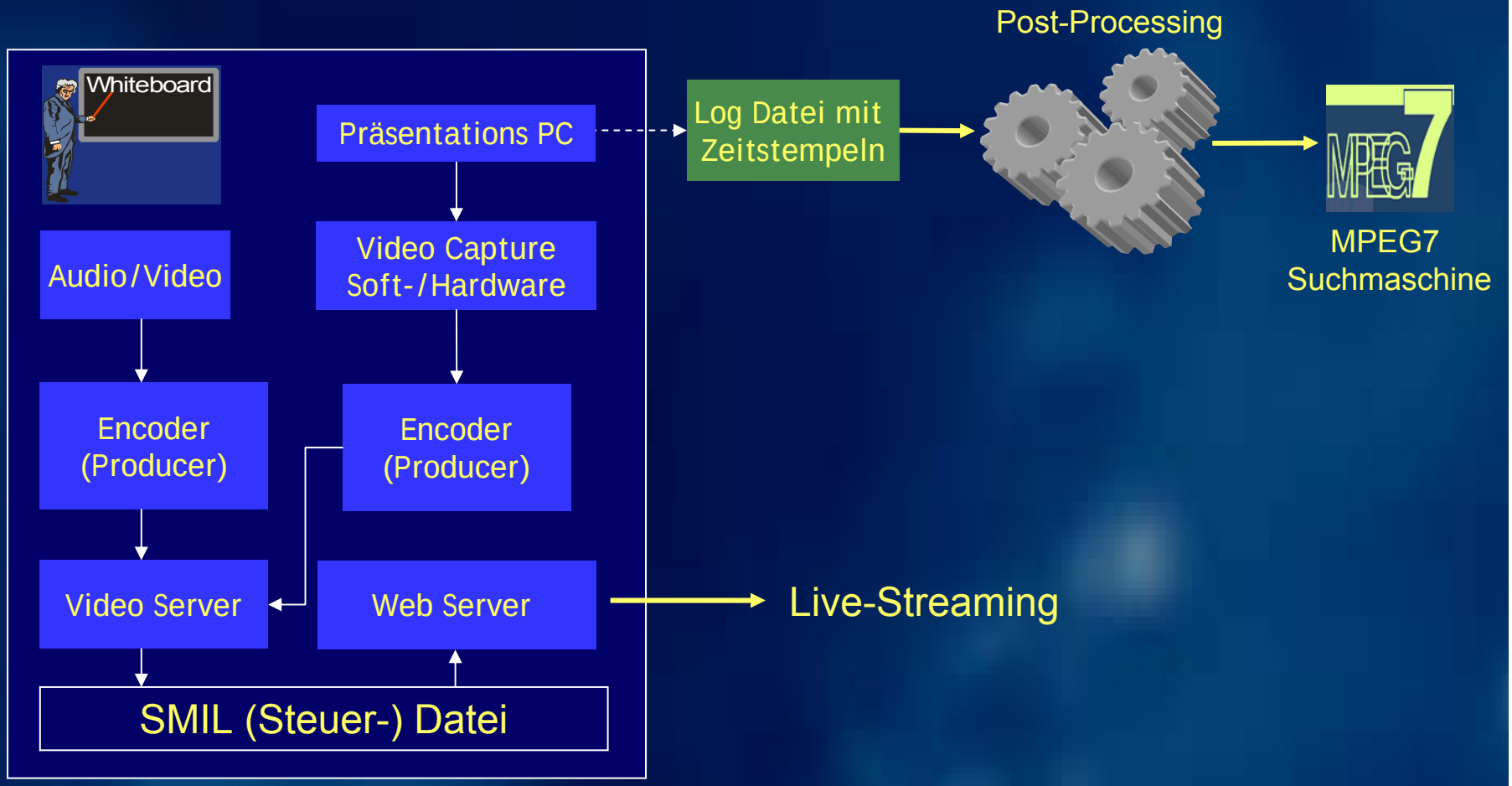
- Tags and Dependencies –
  an Integrated View on Document Annotation
- Osotis –
  Automated and Collaborative Annotation of
  Multimedia Presentations
  http://osotis-base1.inf-ra.uni-jena.de:8180/Osotis/
- NPBibSearch –
  Ontology Enhance Bibliographic Search
  http://ipc755.inf-nf.uni-jena.de/mirror/index.html



- **Related Work → Topic Maps**
  - Topic Maps represent concepts and relationships (conceptional structure and relational structure)

Topic Maps do not include the logical document structure

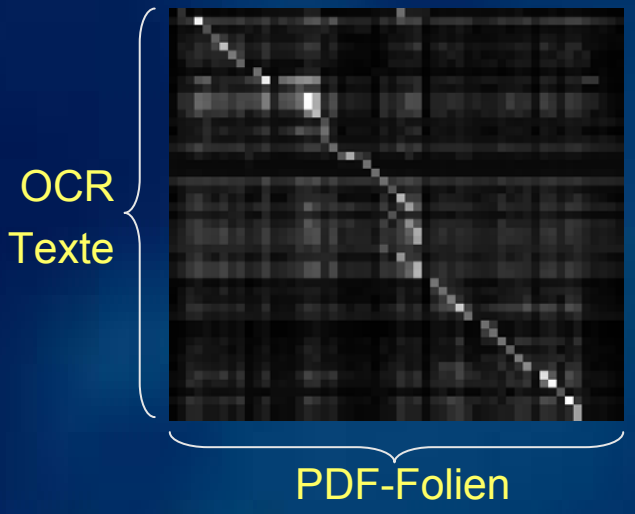
- **Aufzeichnung und Live-Streaming von Lehrveranstaltungen**

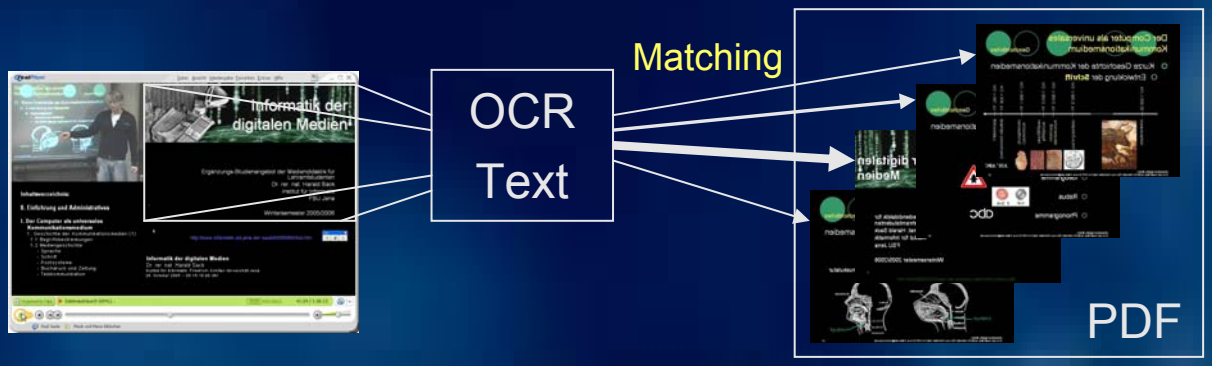


- **Segmentierung des Videos**

Sack, Waitelonis, ESWC 2006

  - **Analysieren der Desktopaufzeichnung**
    - Wann findet ein Folienwechsel statt?
      - Vergleich aufeinanderfolgender Frames
    - Welche Folien sind daran beteiligt
      - Schrifterkennung (OCR)
      - Zuordnung des OCR-Textes eines Frames zu einer Folie notwendig
        → Text-Matching Algorithmus

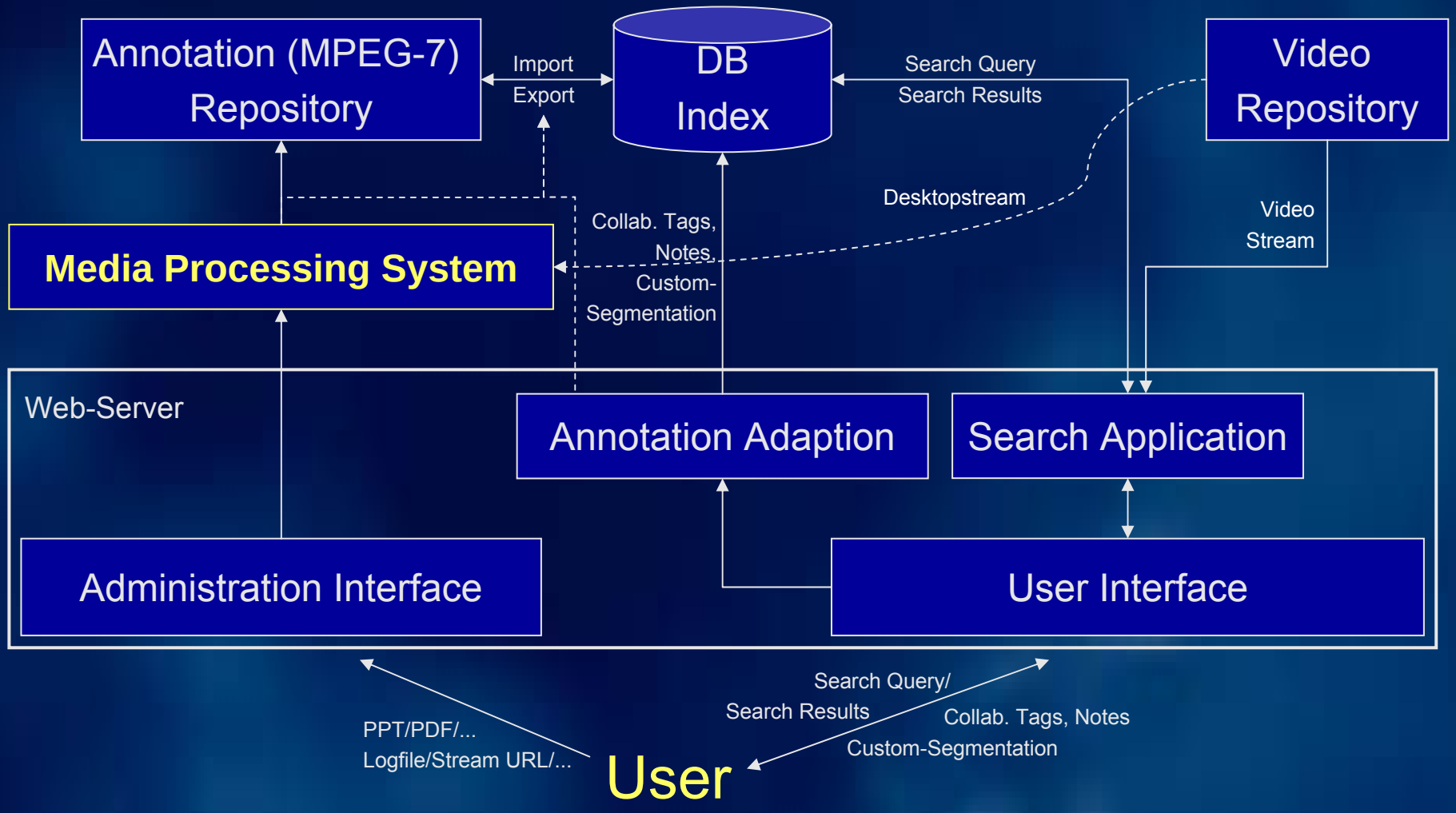




- **Segmentierung des Videos**
  - **Worst Case Szenario**
    - Video ohne jede Zusatzinformation
      - Qualität der Annotation ist abhängig von der verfügbaren Zusatzinformation
      - Manuelle (kollaborative) Annotation

Postprocessing vorhandener und archivierter Videoaufzeichnungen

OCR auf im Video vorhandene Textinformation

Transkription und Analyse der Audio-Information

- **Architektur**