Vom Geschäftsmodell bis zum Semantischen Retrieval – Erfahrungen aus dem DMGLib-Projekt

Bernd Markscheffel

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1 Digital Libraries and Business Models

Digital Library: Definitions

- DL's are..."organized collections of digital information. They combine the structuring and gathering of information, which libraries and archives have always done, with the digital representation that computers have made possible"   Lesk

- DL's are …"organizations that provide resources including the specialized staff to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities"

                    Waters

- DL's …"should not just be seen as static information repositories but as growing, **interactively**, and **collaboratively** used nuclei of what will be at some stage, a good part of human knowledge that depends as much on information as on communication."

                    DELOS

1 Digital Libraries and Business Models

Business Model: Definitions

- "an architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues"   [Timmers]

- "capital model", "procurement model", "goods and services model", "distribution model", "market model", and "service supply model"   [Wirtz]

- "architecture of a firm and its network of partners for creating, marketing and delivering value and relationship capital to one or several segments of customers in order to generate profitable and sustainable revenue streams"

[Pigneur as well as Dubosson-Torbay]

1 Digital Libraries and Business Models

Information Service: Definitions

1. The supplier's major objective is to **provide information services**. Business models that provide information as additional service to support the core supply only (for example, commerce transactions), are not classified as information services.

2. The customer's major objective is to **access information services**.
   He does not visit the information service provider's site for any other reason.
   He searches for information because he wishes solve an information problem.

3. The provision of information services often aims at **making profits**.

1 Digital Libraries and Business Models

Business Modell Classification Approach [Timmers]
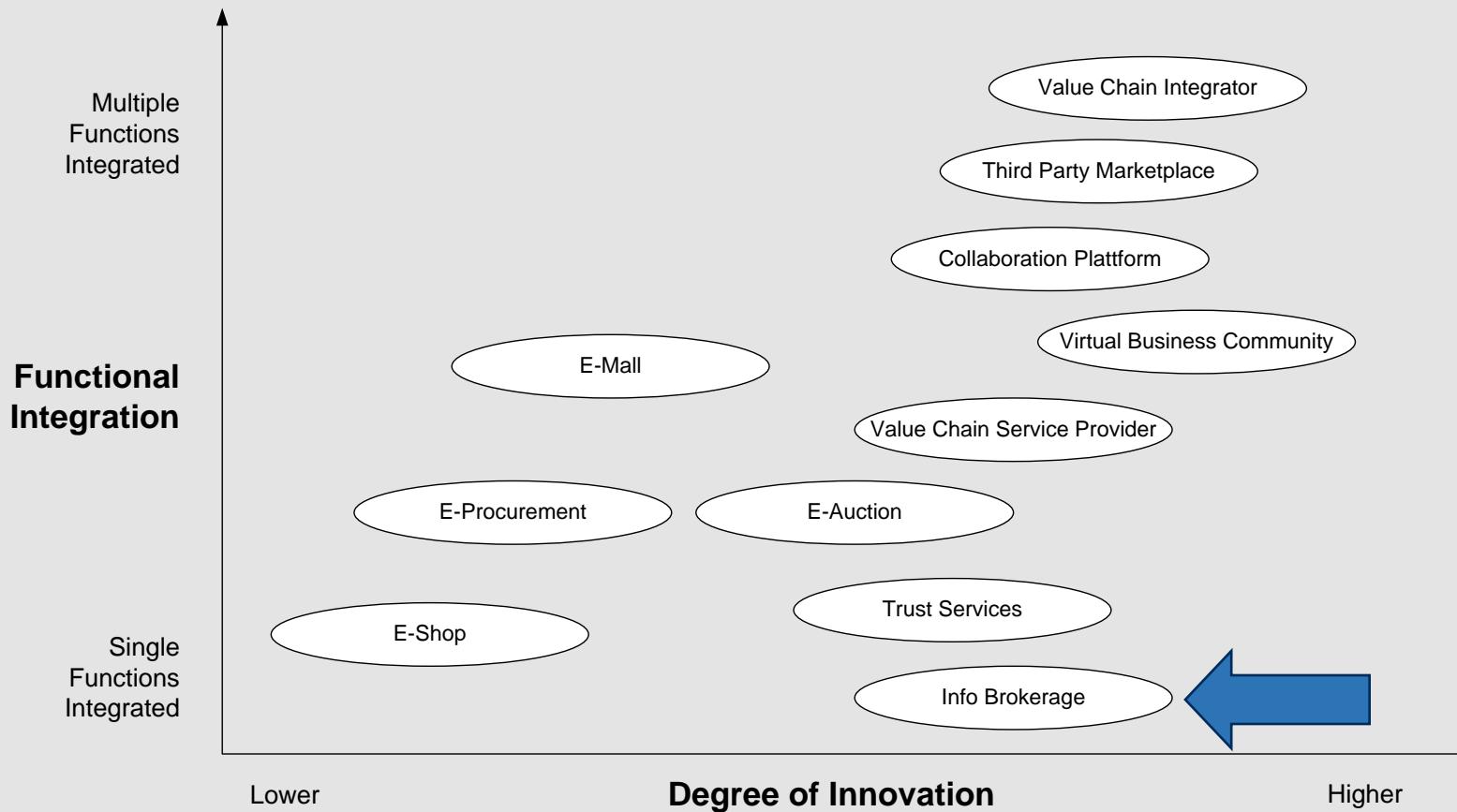
1 Digital Libraries and Business Models

Business Modell Classification [Wirtz et al.]

Business Model Types			
Content	**Commerce**	**Context**	**Connection**
collection, selection, systematisation, compilation, and provision of information	initiation, negotiation and/or processing of business transactions **Definition**	classification and systematisation of information available on the internet	providing tools and services for information exchange and communication
online provision of consumer centred, personalised content	supplement or substitution of traditional commerce transactions on the internet **Objective**	reduction of complexity, navigation	creation of interconnections to support communication
indirect revenues	transaction dependent, direct and indirect revenues **Revenue type**	indirect revenues	direct and indirect revenues
e-information e-entertainment e-infotainment e-education	attraction bargaining/ negotiation transaction **Variants**	search engines, web catalogues	intra- connection, inter- connection
ft.com time.com	dell.com amazon.com ebay.com **Examples**	google.com yahoo.com lycos.com	aol.com gmx.de pobox.com openbc.com

1 Digital Libraries and Business Models

Classification Approach for Digital Libraries

1 Digital Libraries and Business Models

Classification Approach for Digital Libraries

Content → Generalist / Theme Specialist / Information Specialist

Context → Generalist / Theme Specialist / Information Specialist

Community → Generalist / Theme Specialist / Information Specialist

Portal → Horizontal Portal / Vertikal Portal
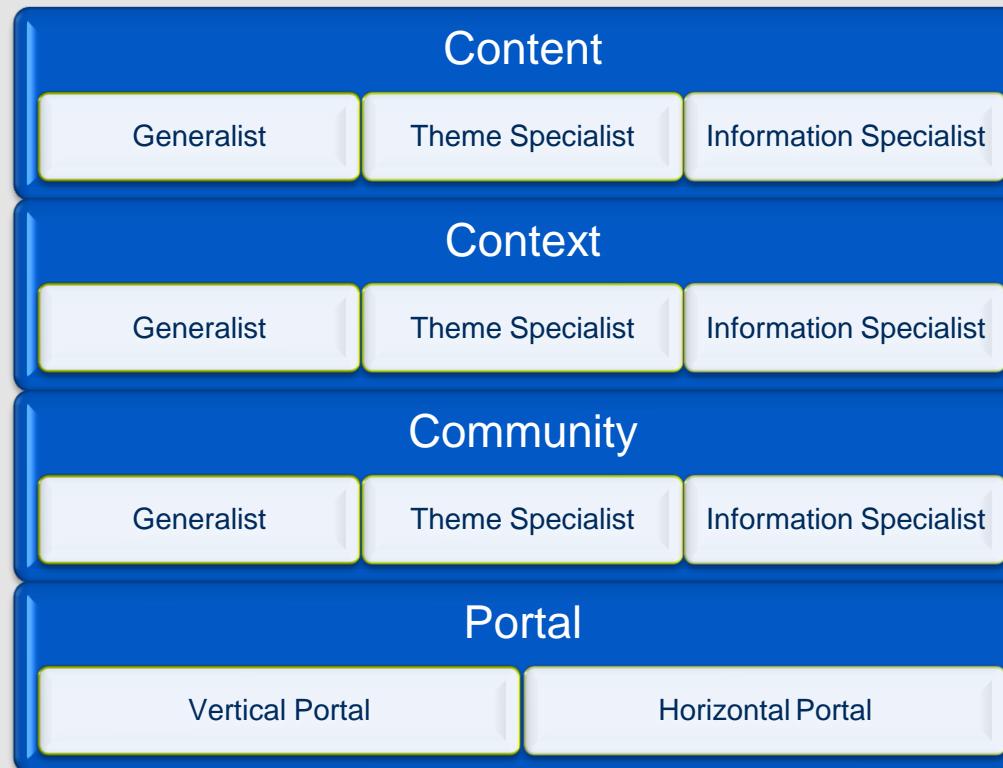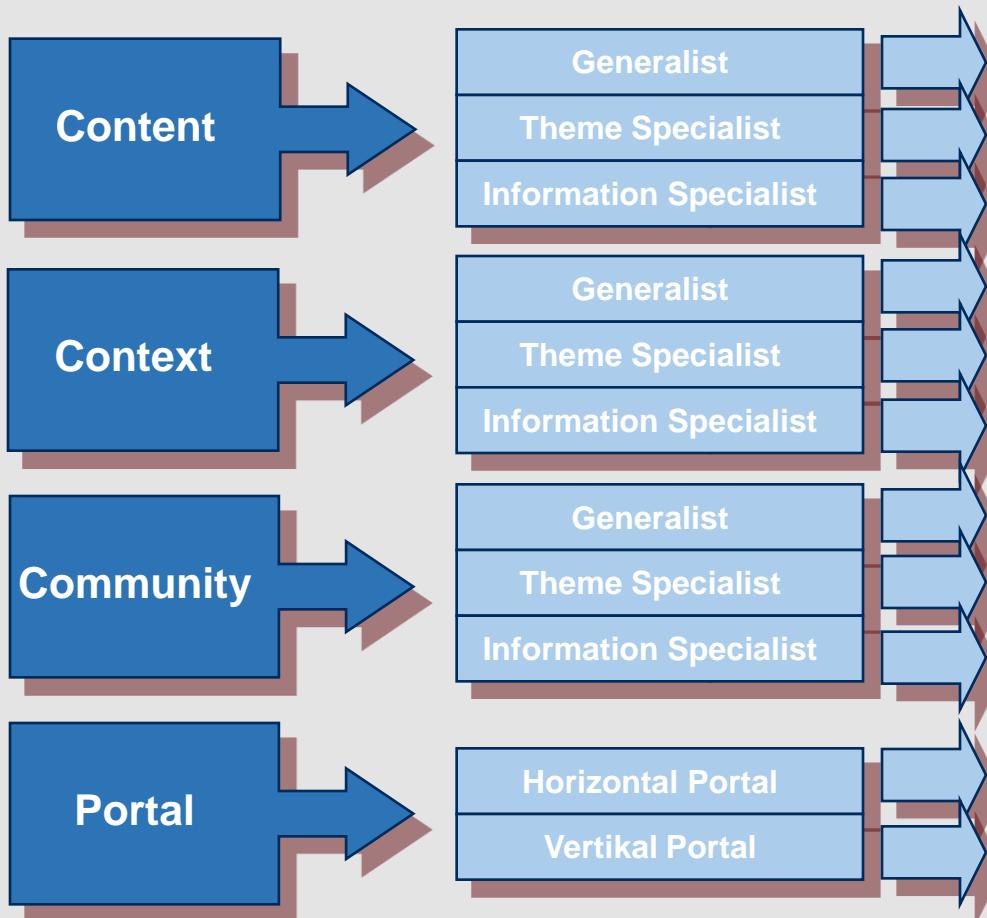
- America Memory, http://memory.loc.gov/ammem/
- Open Video Project, http://www.open-video.org
- Ethnomathematics ,Digital Library http://www.ethnomath.org
- Historical Directories, http://www.historicaldirectories.org
- Alexandria Digital Library Project, http://www.alexandria.ucsb.edu
- Atmopsheric Visualization Collection, http://www.nsdl.arm.gov
- Carrie Electronic Library, http://www.ku.edu/carrie/texts/carrie_books
- Dafodil, http://www.dafodil.de
- Canada's Digital Collections, http://collections.ic.gc.ca
- ELPUB, http://elpub.scix.net/cgi-bin/works/Home
- ACM Digital Library Portal, http://portal.acm.org/dl.cfm?coll=portal&dl=ACM&CFID=49046436&CFTOKEN=89131017
- Digital South Asia Library, http://dsal.uchicago.edu
- California Digital Library, http://www.cdlib.org
- New Zealand Digital Library, http://www.sadl.uleth.ca/nz/cgi-bin/library
- UC Berkeley Digital Library, http://elib.cs.berkeley.edu/
- Digital Resources & Exhibitions - Special collections at Case Western Reserve University, http://library.case.edu/ksl/research/eresources.html
- Digitale Bibliothek Uni-Augsburg, http://www.bibliothek.uni-augsburg.de/digbib/index.html
- Bibliotheksservice-Zentrum Baden-Württemberg
- G-Portal
- http://www.sub.uni-goettingen.de/o_digbib.htm
- Digitale Bibliothek NRW, http://abderos.hbz-nrw.de
- Bayrische Staatsbibliothek, http://www.bsb-muenchen.de/digital.htm

1 Digital Libraries and Business Models

DMG-Lib: A Sample for the Next Generation of Digital Libraries
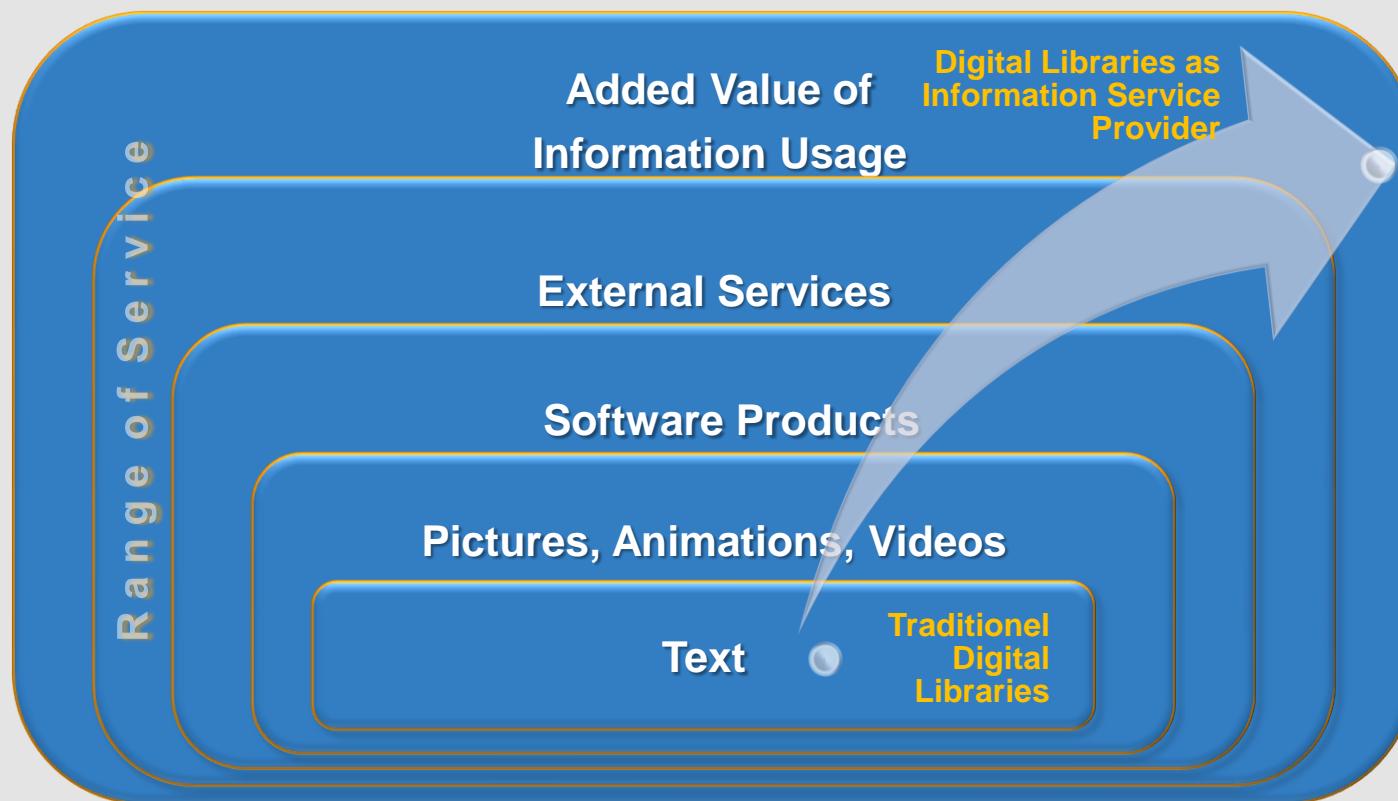
2 Research Context → DMGLib

Motivation

- **Information flood, shortage & -loss**
  - ➡ digital libraries a new knowledge space
- **Goal:**

  best possible access to information

  in different views and data types
- **Characteristics:**
  - – various digital resources
  - – heterogeneous data types
  - – different user groups
  - – focused domain

| Key factor for success: | efficient information retrieval |

2 Research Context → DMGLib

The Digital Mechanism and Gear Library – Project (1/2)

- interdisciplinary project of the TU Ilmenau, Dresden and RWTH Aachen

- financed by the "German Research Foundation"

- **Focus on the mechanisms and gears domain**

- **Goals:**

    – collection

    – preservation

    – integration

    – systematization & enrichment

    – adequate presentation of knowledge on mechanisms and gears

    ➡ **efficient, uniform and user-satisfying information retrieval**

Online portal on: **www.dmg-lib.org**

2 Research Context → DMGLib

DMG-Lib – Project (2/2)

- satisfaction of different user groups:
  - – engineers
  - – scientists
  - – teachers & students
  - – librarians
  - – historians

- **DigitalizationPLUS**

  = enriched of digital resources with various additional information

  (animations, meta-data, references, cross-linking)

➡ **results, experiences, tool will help other digital libraries projects as well**

2 Research Context → DMGLib

DMG-Lib – Information Sources

- solid models   > 1500
- pictures and slices   > 3500
- movies   > 100
- animations
- books
    - older than 1899   > 400
    - 1900 to 1930   > 380
    - 1931 till today   > 350
- journal articles   > 5600
- VDI – guidelines   > 39
- patents   > 1000
- technical blue prints   > 1000

total: **16.000**
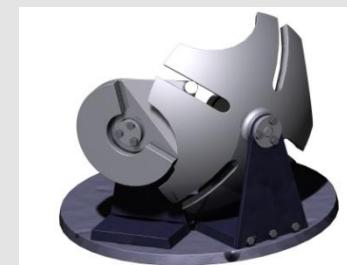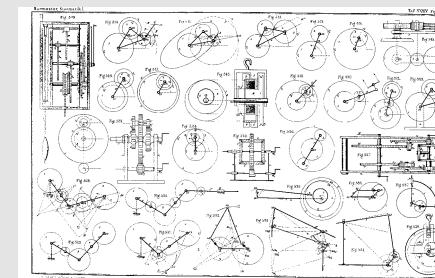
2 Research Context → DMGLib

DMG-Lib – Enrichment
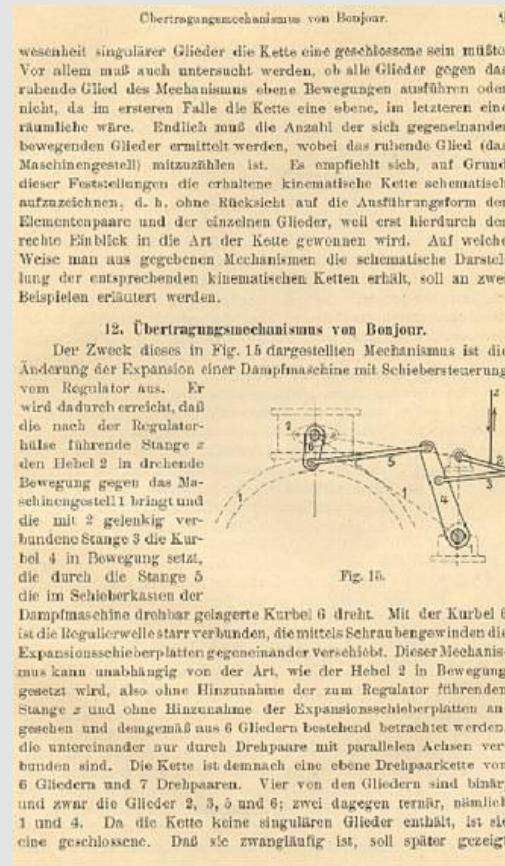
scanned book page

enriched book page

2 Research Context → DMGLib

Portal

2 Research Context → DMGLib

Portal: Book Viewer
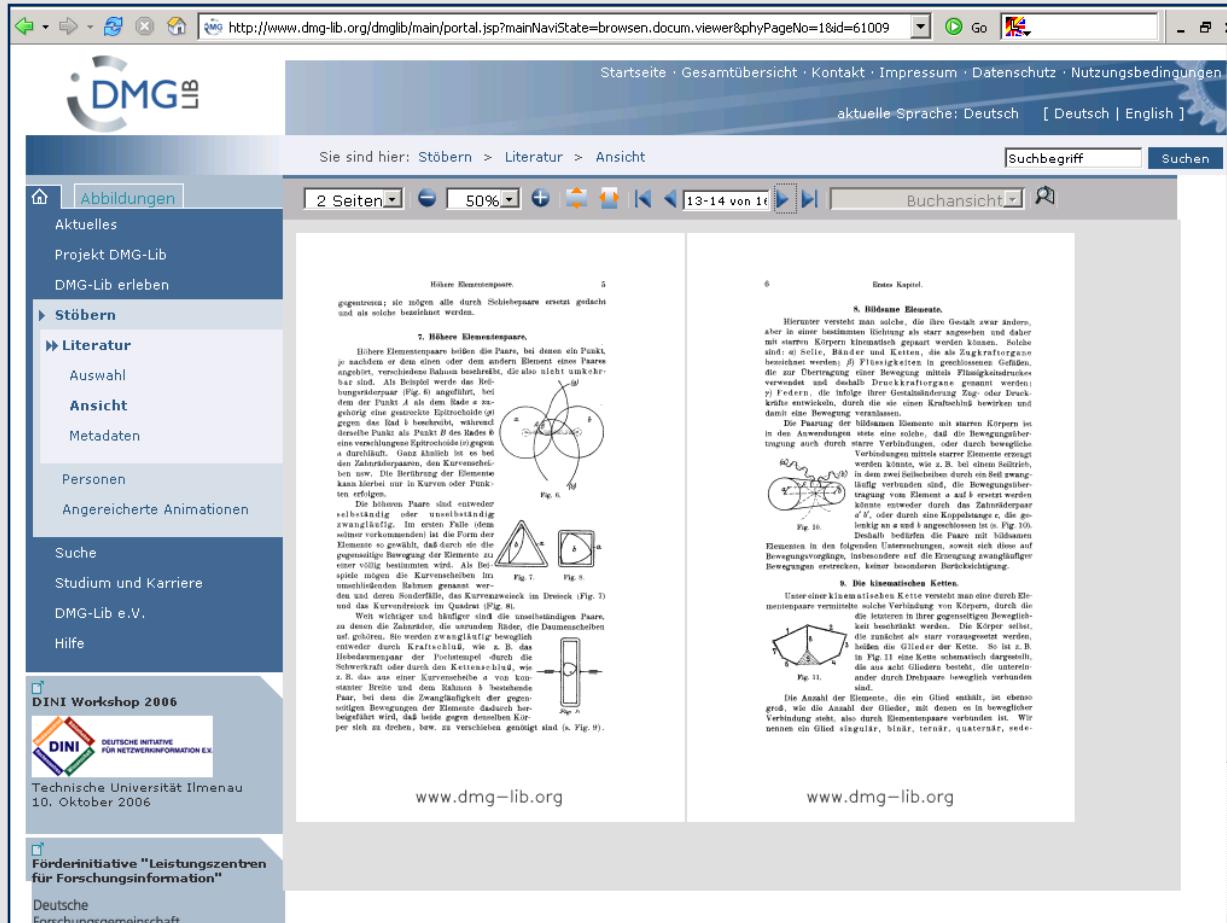
2 Research Context → DMGLib

Production Workflow
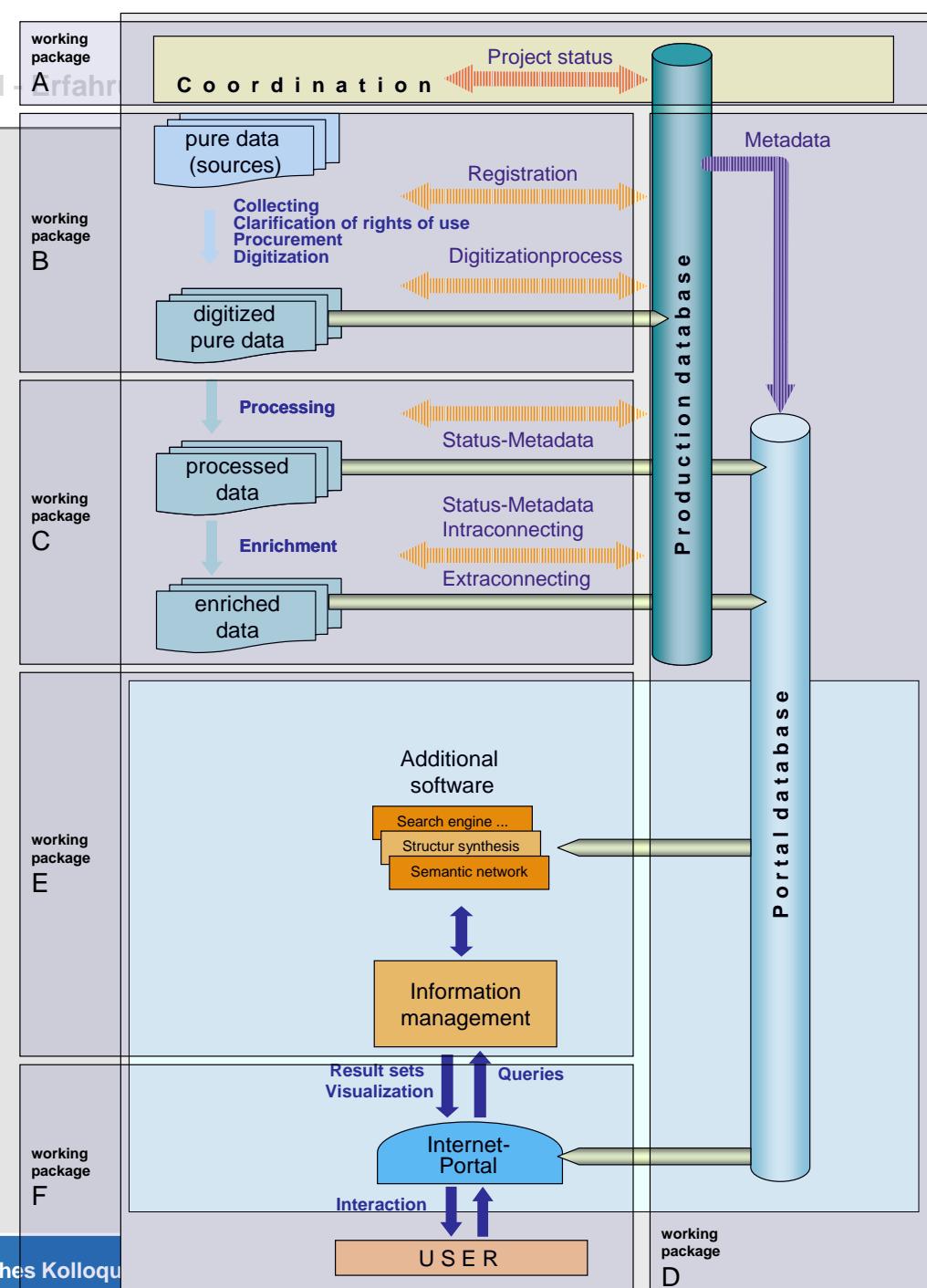
3 Technology → Topic Maps
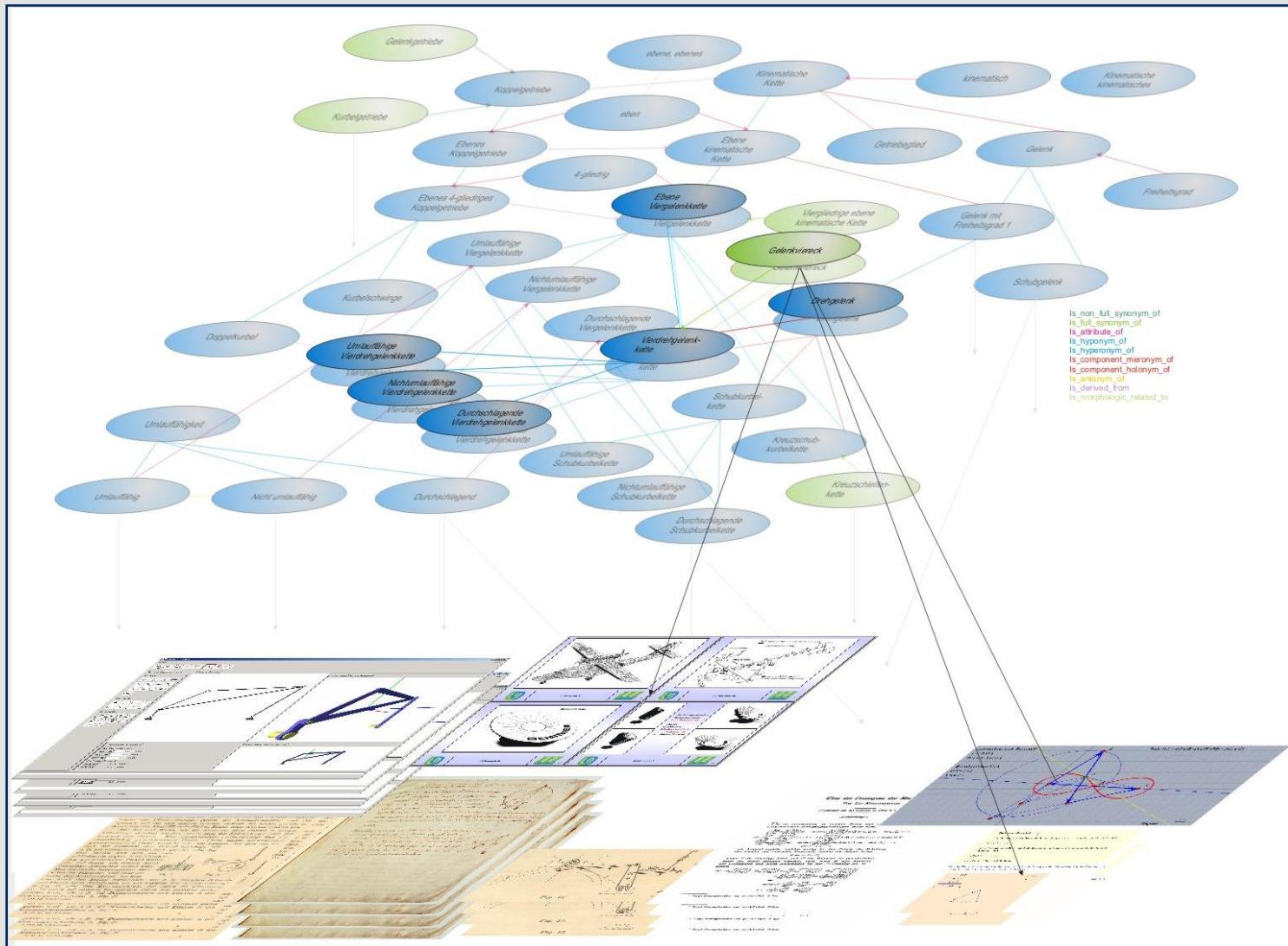
3 Technology → Topic Maps

Topic Maps

Definition

– "**Topic Maps** is a standard for the representation and interchange of knowledge, with an emphasis on the findability of information. The ISO standard is formally known as **ISO/IEC 13250:2003**.

– A single information set can include any number of types of source data: for example, HTML files, PDF files, and databases could all be part of one information set.

– A Topic Map provides a particular view of topics within the information set. There could be, potentially, an infinite number of different TMs for any information set: for example, an information set dealing with the plays of Shakespeare could have a TM for navigation within the perspective of Elizabethan culture, or the perspective of themes throughout the plays. Each TM explicitly declares topics and provides links to relevant information."

Vgl: http://searchwebservices.techtarget.com/sDefinition/0,,sid26_gci520451,00.html

3 Technology → Topic Maps

Topic and Topic Types

– A Topic is a resource that acts as a proxy for some subject; it is the topic map system's representation of that subject. The relationship between a topic and its subject is defined to be one of reification. Reification of a subject allows topic characteristics to be assigned to the topic that reifies it.

– Each individual topic is an instance of one or more classes of topics (also known as Topic Types) that may or may not be indicated explicitly. The default topic type is defined by the "topic" published subject.

Vgl.: http://www.topicmaps.org/xtm/index.html
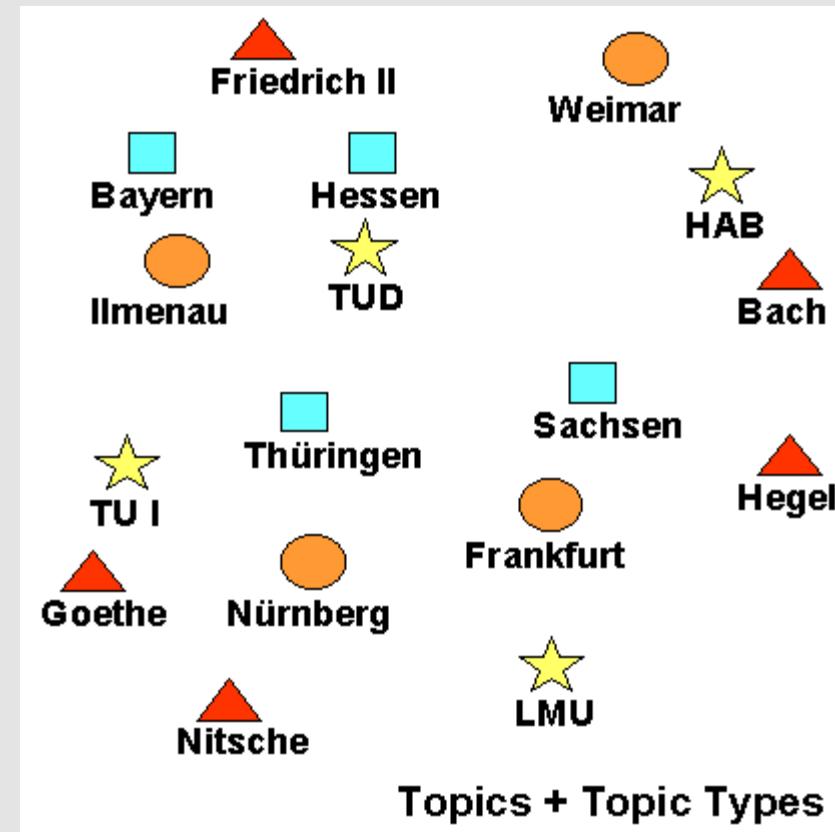
3 Technology → Topic Maps

Occurences and Occurences Types

– An Occurrence is any information that is specified as being relevant to a given subject.

– Occurrences constitute one of the three kinds of characteristic that can be assigned to a topic and are therefore governed by scope.

– Each individual occurrence is an instance of a single class of occurrence (also known as an occurrence type) that may or may not be indicated explicitly. The default occurrence type is defined by the "occurrence" published subject.

Occurrences + Roles

Vgl.: http://www.topicmaps.org/xtm/index.html
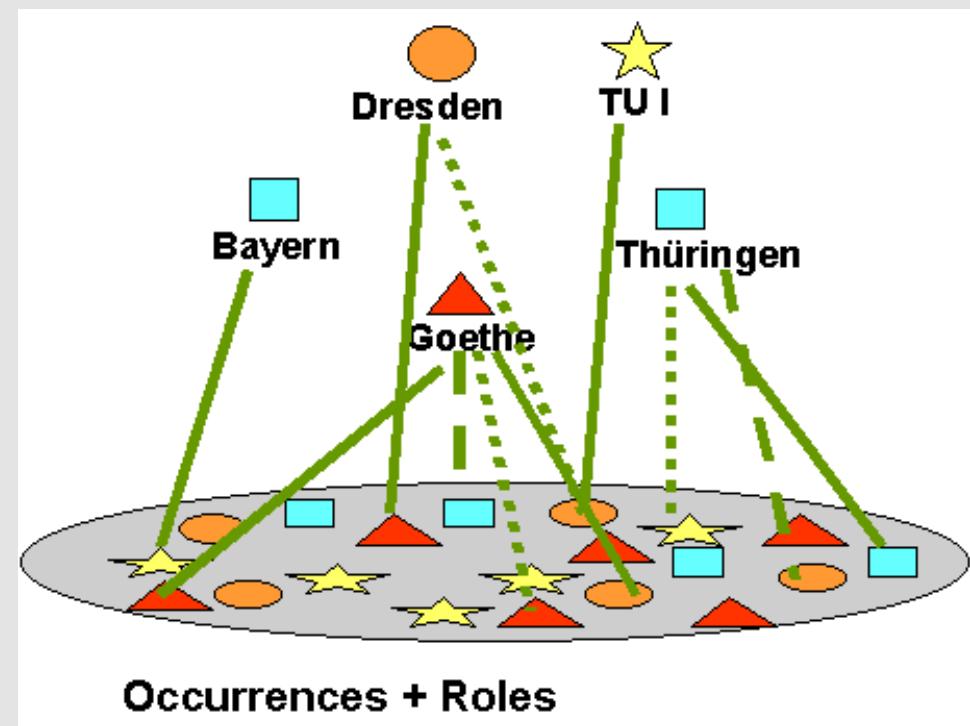
3 Technology → Topic Maps

Associations

– An association is a relationship between one or more topics, each of which plays a role as a member of that association.

– The roles a topic plays in associations are among the characteristics that can be assigned to it and are therefore governed by scope.

– Each individual association is an instance of a single class of association (also known as an association type) that may or may not be indicated explicitly. The default association type is defined by the "association" published subject.

Vgl.: http://www.topicmaps.org/xtm/index.html
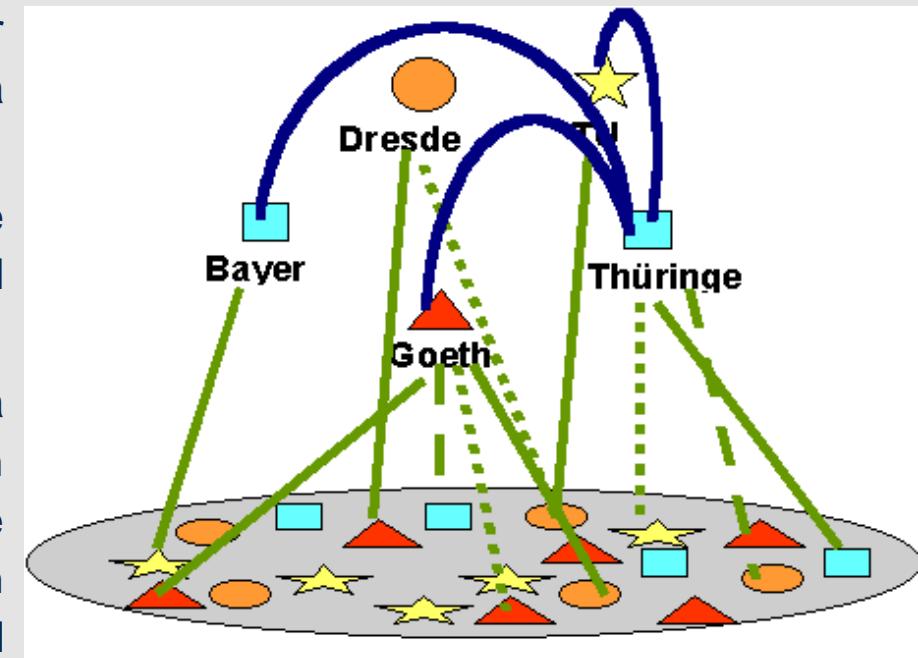
3 Technology → Topic Maps

Scopes

– Scope escifies the extent of the validity of a topic characteristic assignment.

– It establishes the context in which a name or an occurrence is assigned to a given topic, and the context in which topics are related through associations.

– Every characteristic has a scope, which may be specified either explicitly, as a set of topics, or implicitly, in which case it is known as the unconstrained scope. Assignments made in the unconstrained scope are always valid.

```
<TOPIC id="deutsch">
<TOPIC id="englisch">
<TOPIC id="französisch">
<TOPIC id="Städte">
        <NAME scope="deutsch">
        <FULLNAME>Städte</FULLNAME>
        </NAME>
<NAME scope="englisch">
        <FULLNAME>Cities</FULLNAME>
        </NAME>
<NAME scope="französisch">
        <FULLNAME>Villes</FULLNAME>
        </NAME>
</TOPIC>
```

Vgl.: http://www.topicmaps.org/xtm/index.html

3 Technology → Topic Maps

XTM-DTD

```
<!-- DTD for Contributors documents    -->
<!-- DOCTYPE DOCUMENT PUBLIC"-//STEP//DTD Topic Map XML DTD v1.0//EN" [] -->
<!-- COPYRIGHT - (C) STEP-uk -->
<!-- AUTHOR:     Graham Moore -->
<!-- *********************************************************************** -->
<!-- topicmap is the root element -->
<!-- *********************************************************************** -->
<!ELEMENT   topicmap            (topic | assoc | facet)*>
<!ATTLIST      topicmap
     xmlns:xlink           CDATA                    #FIXED "http://www.w3.org/XML/XLink/0.9"
        name               CDATA                    #IMPLIED>
<!-- *********************************************************************** -->
<!ELEMENT   topic           (topname* , occurs*)>
<!ATTLIST         topic
     xmlns:xlink        CDATA                        #FIXED "http://www.w3.org/XML/XLink/0.9"
            ID                 ID                       #REQUIRED
        xlink:type            (simple|extended|locator|arc)      #FIXED "extended"
         types                CDATA                   #IMPLIED
         scope                CDATA                   #IMPLIED
         identity             CDATA                   #IMPLIED
         linktype             CDATA                   #IMPLIED>
<!-- *********************************************************************** -->
<!ELEMENT   occurs           EMPTY>
<!ATTLIST         occurs
     xmlns:xlink        CDATA                        #FIXED "http://www.w3.org/XML/XLink/0.9"
        xlink:type            (simple|extended|locator|arc)      #FIXED "locator"
        xlink:href            CDATA                   #REQUIRED
         type                 CDATA                   #IMPLIED
         occrl                CDATA                   #IMPLIED            …
```

4 Lessons Learned → Lesson 1: Workflow

- Key challenge: model the relevant aspects of the application domain to enhance the Information Retrieval with semantic technologies
    - Application domain: Gears, Mechanisms, Curves, Tables, Solid Gear models, Videos, …

- Very complex and time consuming process
    - Necessary to reduce complexity by structuring this process
    - How?
        - Adopt a Workflow for Ontology design for TM application

4 Lessons Learned → **Lesson 1: Workflow**
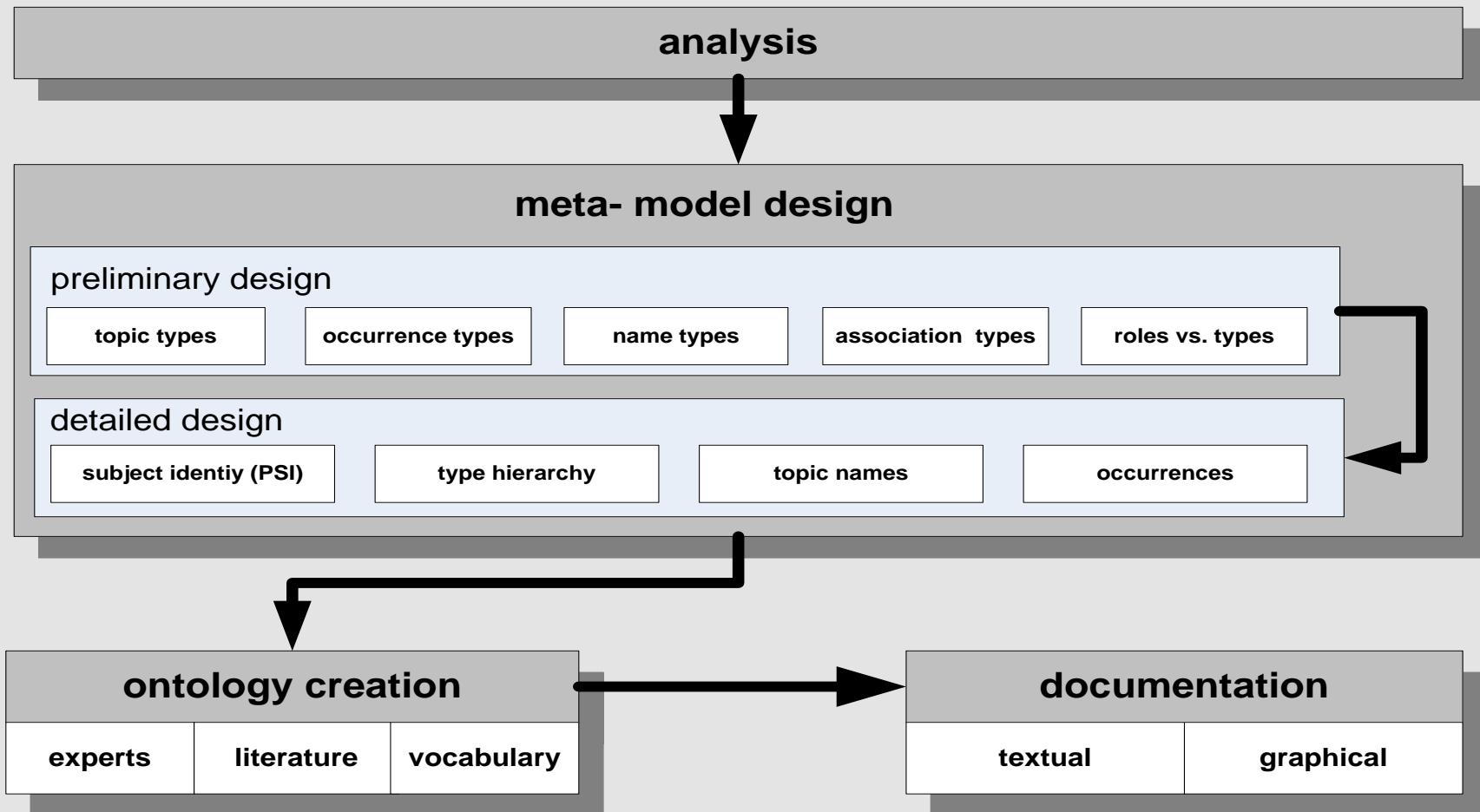
4 Lessons Learned → Lesson 2: (Meta-)Modeling

- (Meta-)model necessary
  - To describe syntax and semantic of the modeled structures and its elements (**topics**: names, base name, scope, identificator (PSI), **associations…association types…occurences…**
  - To simplify the upgrading of the TM
  - To simplify and support the collaboration within the modelling process
    - Example: subjects are represented as an individual topic node identified by the <subjectIdentity> of the <topic> element or via PSI

```
<topic id="123">
<subjectIdentity>
<subjectIndicatorRef
    xlink:href=" http://dogbert.prakinf.tu-
    ilmenau.de/~hendrik/dmglib/doku.php?id=psi2:psi1.1.1" />
</subjectIdentity>
</topic>:
```

4 Lessons Learned → Lesson 2: (Meta-)Modeling
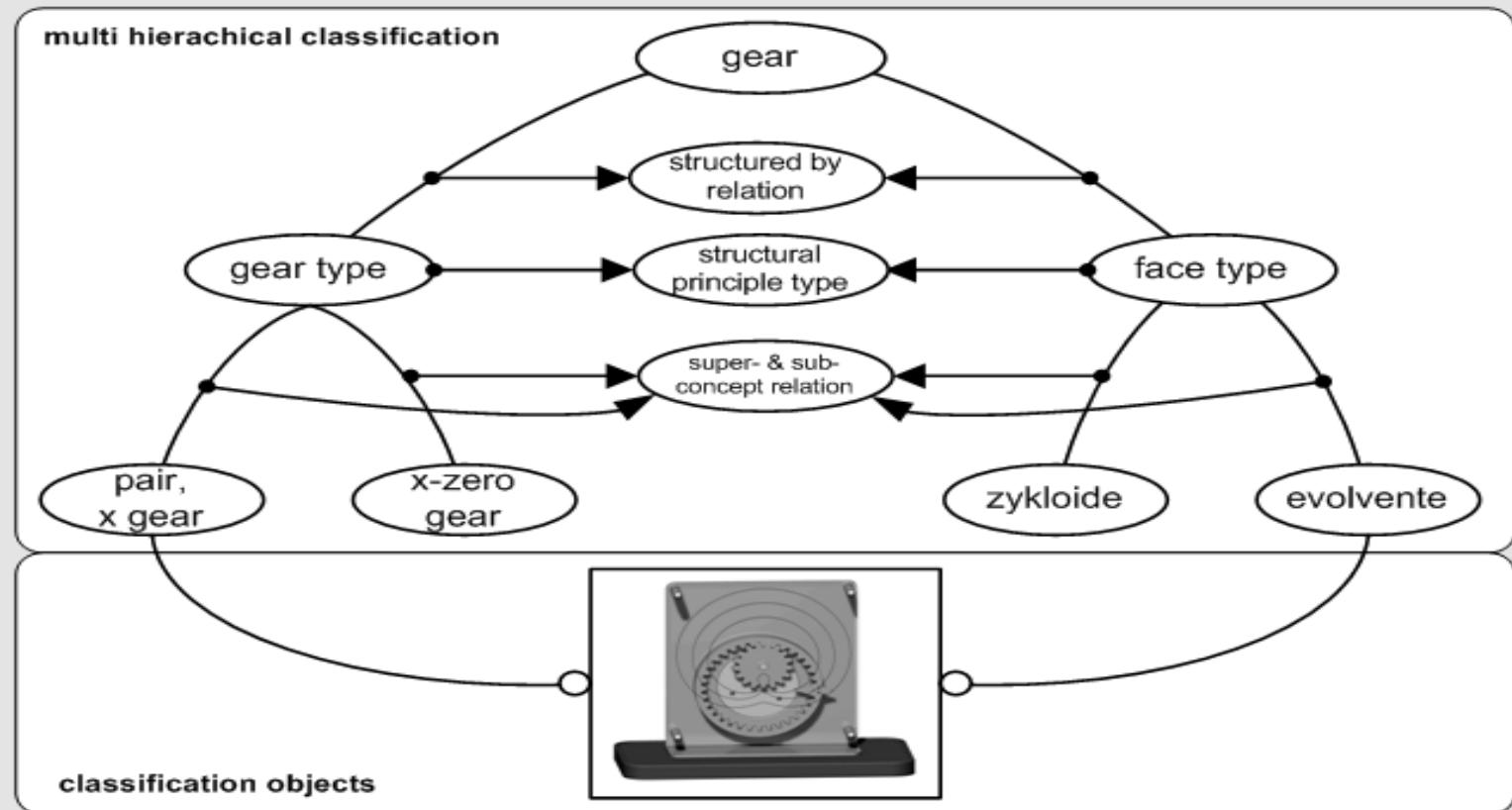
4 Lessons Learned → **Lesson 3: Notation**

- Ontoly creation is a collaborativ process
- Several types of users involved:
  - Knowledge engineers
  - Librarians
  - Domain experts (machine builduing engineers,
  - Users
- Support of discussion
- Documentation
  - Graphical representation is necessary

4 Lessons Learned → **Lesson 3: Notation**

domain view of the topic map draft in GTM^{beta}:
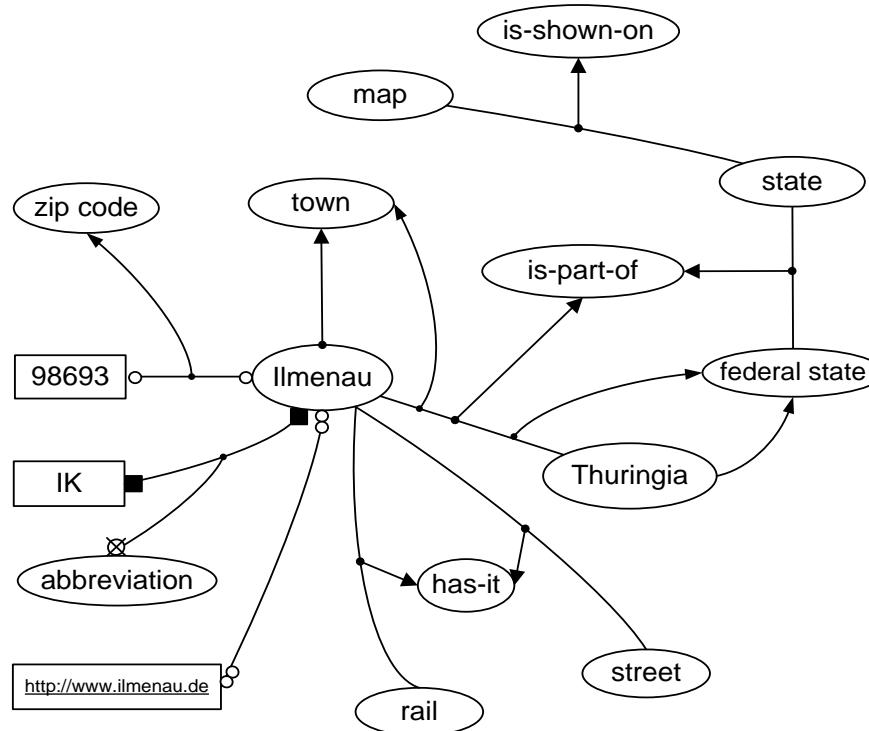
topic map draft in LTM:

/*topics*/
[Ilmenau:town = ``Ilmenau''; ; /German
                     = ``IK''/abbreviation)
 @``http://www.ilmenau.de'']
[Thuringia: federal state]
[street: traffic connection]
[rail: traffic connection]
[state] [map]
/*associations*/
is-part-of (Ilmenau:town,
Thuringia:federal state)
is-part-of (federal state, state)
is-shown-on (state, map)
has-it (Ilmenau, street)
has-it (Ilmenau, rail)
has-status (Ilmenau, county seat)
/*occurrence*/
{Ilmenau, zip code, [[98693]]}

GTM^{beta}

Hendrik Thomas[1], Tobias Redma[...]
Maik Pressler[2], Bernd Marksche[...]
[1] KDEG Trinity College, Irelan[...]
[2] Ilmenau University of Technology, [...]

* 15.10.2008 *

Abstract. In the last 5 years several drafts, recommendations a[...]
for a graphical notation for Topic Maps have been pub[...]
untill today no graphical notation is generally approved and [...]
Topic Maps community. This paper presents GTM^{alpha} as a[...]
new notation for a graphical representation of Topic [...]
objective is to provide a practical usable notation, which allows[...]
consistent as well as easy to use graphical representa[...]
given topic map draft. GTM^{alpha} provides a domain- as well a[...]
centric view and most importantly it considers the unique chara[...]
the Topic Maps paradigm. This paper serves as a user oriente[...]
manual for ontology designers, domain experts as wel[...]

1. Basic Design

- 2 dimensional graph layout & black and whit[...]

- Topics represented by a unique shape

- Data vaules represented by a unique shape

- Add symbols to indicate the role of an eleme[...]

(Topic) Types	Topic Name	Scope	Subject Identity	
↑	Base Name ■ Variant Name □	⊗	Subject Identifer ○○ Subject Locator ●●	

- Any text outside a shape is a comment

2. Topics

topic   topic   topic

3. Topics Types

topic type   *topic type*

town   country

Ilmenau   Germany   USA

topic   topic   topic

4. One-Topic-Per-Subject

topic type   *topic typ[...]*

① country   ① countr[...]

Germany   USA

topic   topic

5. Topic Names

IK
ILMENAU   ILM

topic   base-name   variant name
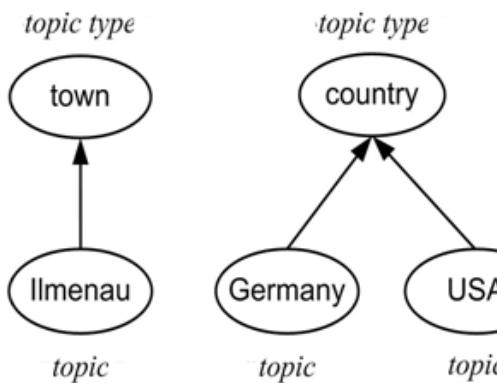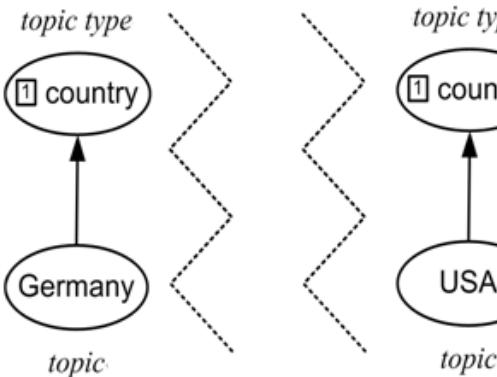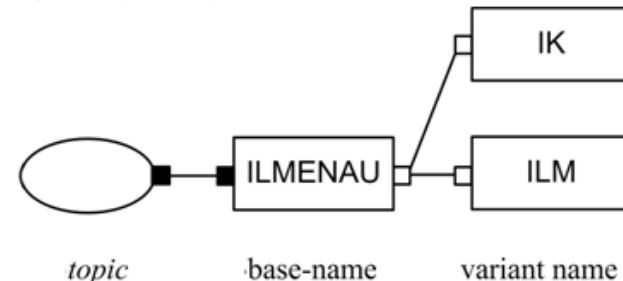
6. Topic Names With Type and Scope

scope   *scope*
German   abbreviation

ILMENAU   TUI

topic   base-name   variant name

official name

topic name type

7. Topic Names Short Cut

ILMENAU

topic

EQUAL

ILMENAU

topic   base-name

8. SUBJECT IDENTITY

Ilmenau ——○○————○ http://www.ilmenau...

topic — subject identifier

street map ——●●————● http://ilm.de/map.j...

topic — subject locator

9. OCCURRENCES

Ilmenau ——○————□ 98693

topic — internal occurre...

Leipzig ——○————□ http://leipzig.c...

topic — external occurre...
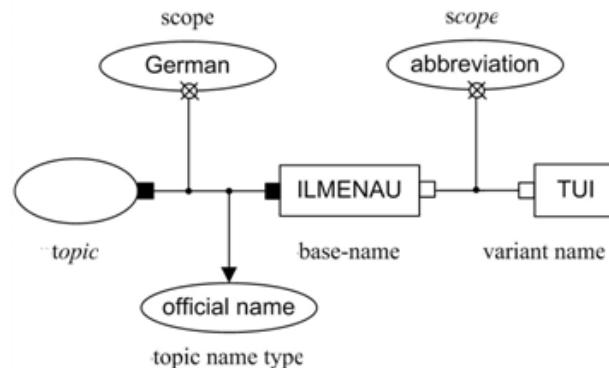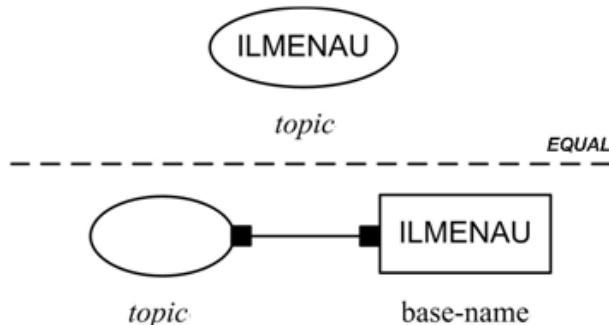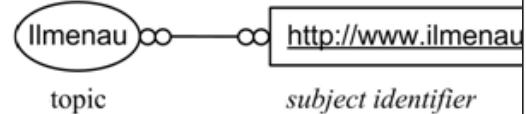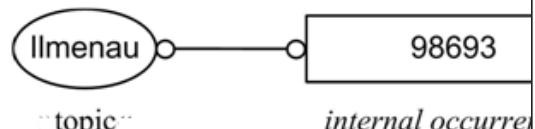
10. OCCURRENCES WITH TYPE AND SCOPE

scope

Germany ⊠

Ilmenau ——○———————□ 98544

topic — internal occu...

zip code

occurrence type
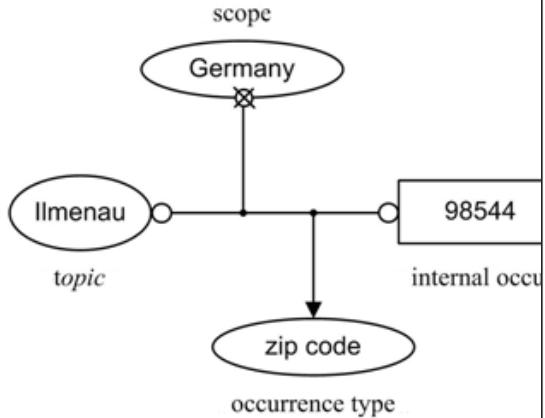
11. SIMPLE ASSOCIATION

Ilmenau ————————

topic

12. ASSOCIATION WITH TYPE & SCOPE

association type

is-part-of

Ilmenau ————————●————————

topic

Germany ⊠

scope

13. ASSOCIATION WITH TYPE & SCOPE &

role type — association type — role type

part — is-part-of — whole

Ilmenau ——●————●————●

topic

Germany ⊠

scope

14. REIFICATION

topic — base-name

ILMENAU

reification

created-by

association

15. VIEWS

domain view of GTM^{alpha}

LTM

```
/*topics*/
[Ilmenau:town = ``Ilmenau''; ; /German
        = ``IK''/abbreviation)
  @``http://www.ilmenau.de'']
[Thuringia: federal state]
[street: traffic connection]
[rail: traffic connection]
[state] [map]
/*associations*/
is-part-of (Ilmenau:town,
  Thuringia:federal state)
is-part-of (federal state, state)
is-shown-on (state, map)
has-it (Ilmenau, street)
has-it (Ilmenau, rail)
has-status (Ilmenau, county seat)
/*occurrence*/
(Ilmenau, zip code, [[98693]])
```

subject centric view of GTM^{alpha}
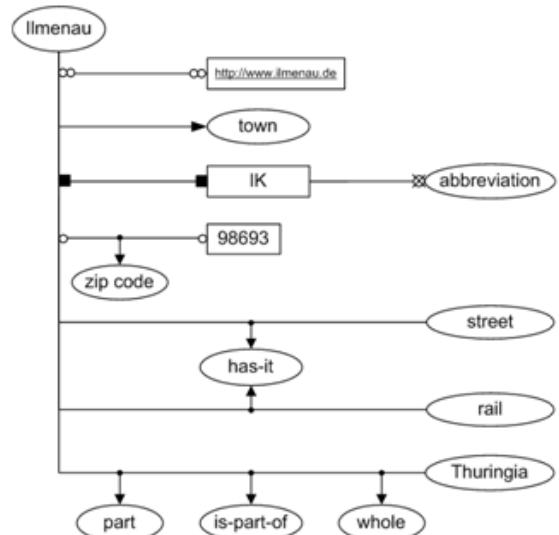
16. BEST PRACTICE HINTS

- use of color is not forbidden - useful to highlight important things
- size of symbols not pre-defined - increase the size of a topic to draw attention to it
- connecting lines can be strait or curved depending on the layout
- crossings of lines should be avoided
- lines for associations should be drawn thicker than lines between Topic Maps constructs
- all symbols and elements can be rotated, without loosing their unambiguous meaning

4 Lessons Learned → **Lesson 4: Editing**

- Process of creation of the Topic Map is very complex
- Calls for tool support
    - Especially in the construction phase a powerful editor is necessary
        - Requierments:
            - Support of collaborative modeling process
            - User friendly, fast, adoptable
            - Basic search capabilities
            - Unicode support
            - Support the two task editing process
                - (1) Encode the identified concepts into a topic map
                - (2) Link the concepts with addressable relevant information resources

4 Lessons Learned → **Lesson 4: Editing**

TMWiki (2006)

Tmedit (2008) tmedit.org

- Based on Dokuwiki

- User needs XML-basics

- no search capability

- In- & export option

- Connection to TMV

- Open Source, uses a tmapi com-patible Topic
  Maps engine (tinyTim)

- Customizable GUI (Apache Velocity)

- Powerful search capability via Apache Lucene

- UTF-8 support

- Works with, and creates XTM-files

4Lessons Learned → Lesson 5: Visualization

Remember Lesson 3 !

- Ontology creation is a collaborativ process
- Several types of users involved:
    - Knowledge engineers
    - Librarians
    - Domain experts (machine builduing engineers,
    - Users
- Support of discussion
- Documentation
    - Graphical representation is necessary
    - Visualization of the representation is:
        - essential for the communication
        - a helpful supplement for the information retrieval

# 4 Lessons Learned → Lesson 5: Visualization

TMV   (2006)
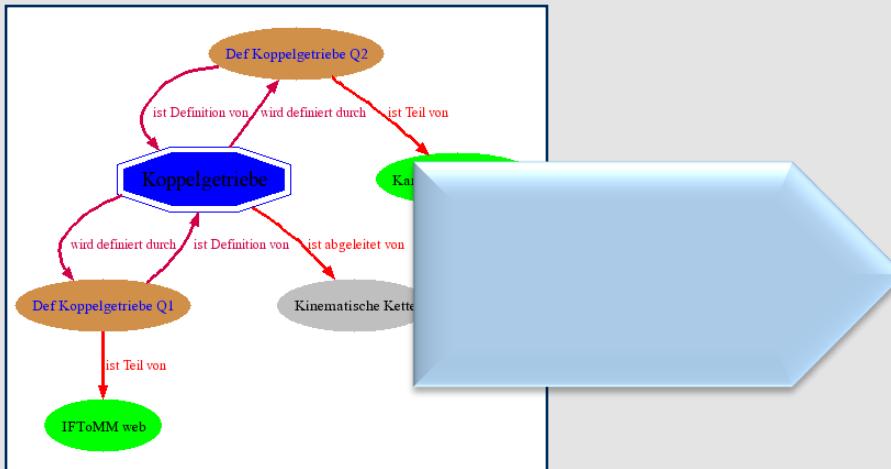
Topic Map Viewer within the TMWiki-enviroment

+ Hirarchical views

+ Pearl implementation (slow)

- Permanent change of the figure

- Limited to a network representation

TMchartis (2008)
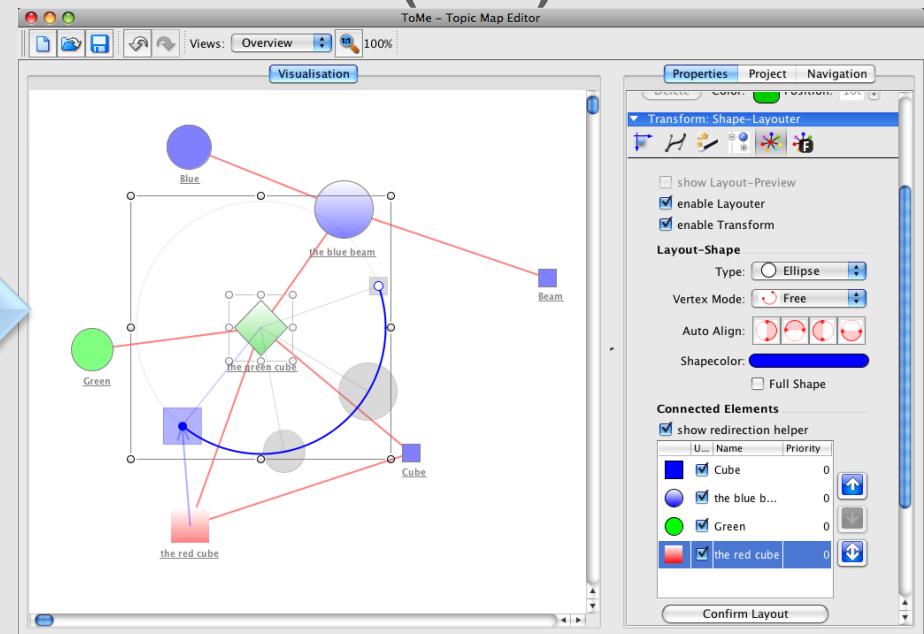
Standalone TM-Viewer

+ Problem oriented views

+ Configureable interface (user interface, colours, shapes, lours)

+ Network compatibel (java based)

- Needs MySQL-DB

4 Lessons Learned → Lesson 6: Integration

- Modeling the gears and mechanism domain with TopicMaps offers a lot of opportunities for integration and application

- Main problem:
    - capability to infer from the information resources to the concepts encoded in the topic map and vice versa

- Some prototyping solutions:
    - Semantics enhanced full text search
    - Integration of the various text
    - TMGlossar
    - TMDictionary

4 Lessons Learned → Lesson 6: Integration

TMGlossar

4 Lessons Learned → Lesson 6: Integration

TMDictionary

5 Sustainability → Roadmap for Business Model Development

6 Summary

- Semantic technologies are able to improve Information Retrieval process for DL's
- Ontology development is a complex rrocess
  - It demands for Collaborative Development
  - It demands for Tool Support
- Business model is essential for a sustainable survival
- Managing people are the trickiest part of the project

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Thnx for your attention !

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