



Intelligente Techniken für das Wissensmanagement

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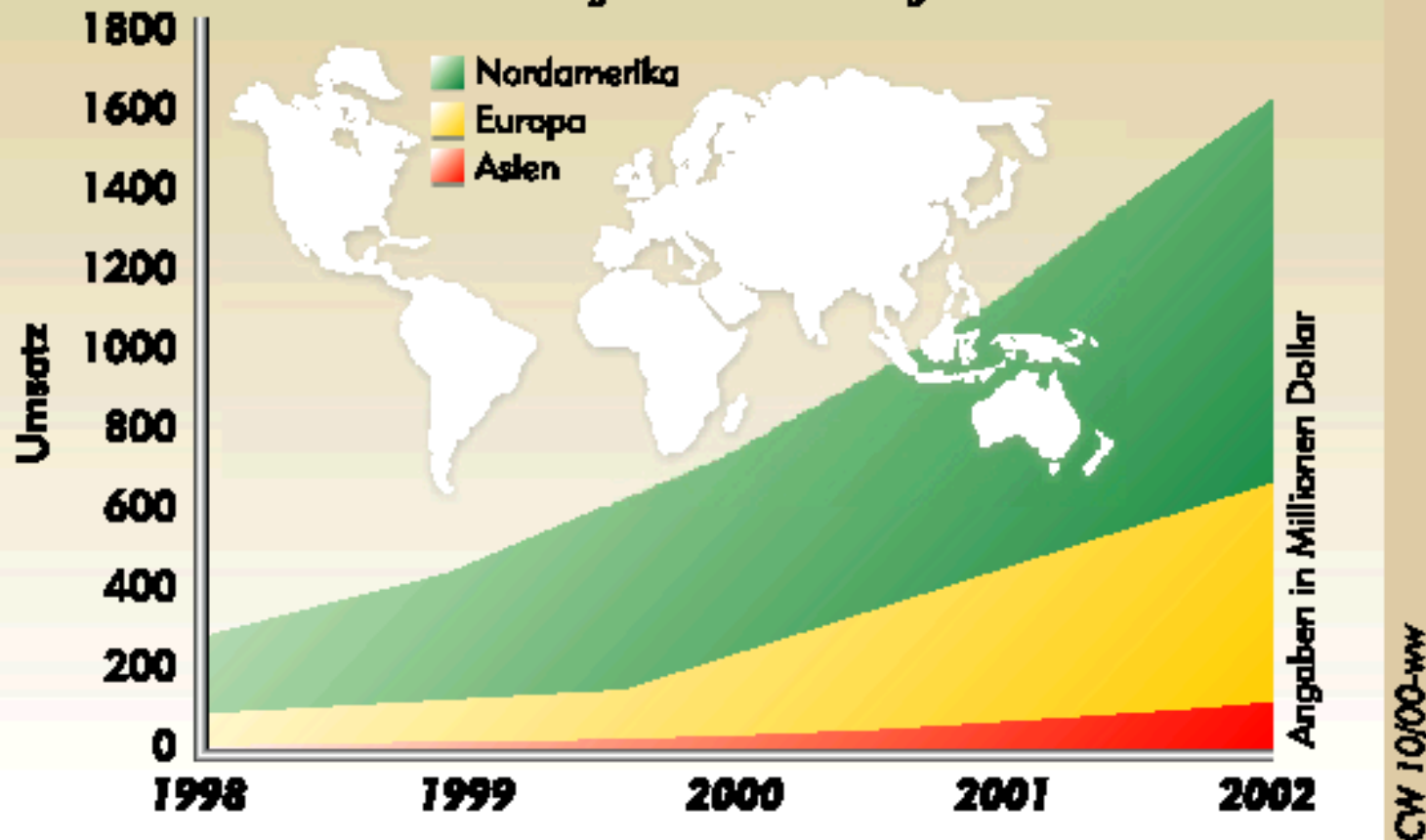
Tutorium auf der WM-2001

14.3.2001 in Baden-Baden



STETIGES WACHSTUM

Der Markt für KM-Software



DER BEDARF AN PROGRAMMEN zur Wissensverwaltung im Unternehmen steigt auch in den nächsten Jahren weiter an. Quelle: IT-Research

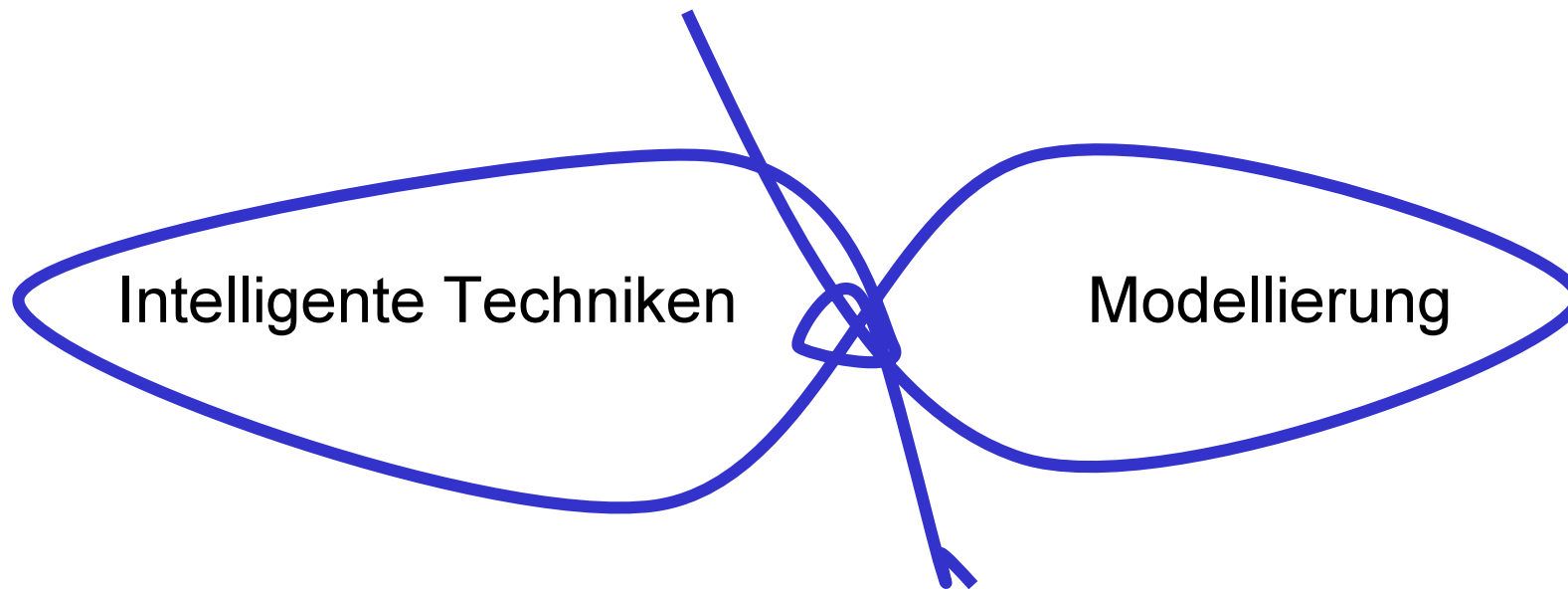


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- 4. Knowledge Management Scenario - CIN**



1.1 About the Lecturer

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Studium der Informatik in Erlangen, Philadelphia, Freiburg

- Consultant bei Fraunhofer IAO
- Mitgründer von Ontoprise GmbH
- Wissenschaftler bei British Telecom
- Wissenschaftlicher Assistent am AIFB, Universität Karlsruhe (TH)

Forschungsinteressen:

- Wissensmanagement
- Informationsextraktion
- Ontologien
- Knowledge Discovery,
- Web-Anwendungen
- Semantic Web

1.2 Introduction to Knowledge Management

"Today's most technologically advanced economies are truly knowledge based. And as they generate new wealth from their innovations, they are creating millions of knowledge-related jobs in an array of disciplines that have emerged overnight: knowledge engineers, knowledge managers, knowledge coordinators."

[World Development Report 98/99]

1.2 Introduction to Knowledge Management

Why interest in Knowledge?

- Increased speed of Knowledge Creation (Research)
- shorter development cycles with more intelligent, sophisticated products
- increasingly complex regulations (environmental standards, suit risks...)
- Globalization of Economy (more competitors, complex markets with different cultures)
- Knowledge and Information is an economic asset itself
- Increasing fraction of Knowledge Intensive Work

1.2 Introduction to Knowledge Management

Knowledge Work

- Knowledge Work is based on the Creation and Application of Knowledge - usually no fixed workflow and lot of Exceptions:
 - Research
 - Product Development
 - Medicine
 - Law
 - Diagnosis and Maintenance of complex Machine
- Shorter development cycles with more intelligent, sophisticated products
- Single activities in conventional processes are knowledge work
 - Loan approval
 - Risk assessment of Insurance Policies

1.2 Introduction to Knowledge Management

Knowledge needs to be maintained

- Employees are the primary knowledge sources (but change employer)
- Knowledge is a power factor and is usually not shared
- Lessons learned are not recorded and reviewed (costly!)
- Knowledge Worker are using 50-80% of their work time for information search



1.2 Introduction to Knowledge Management

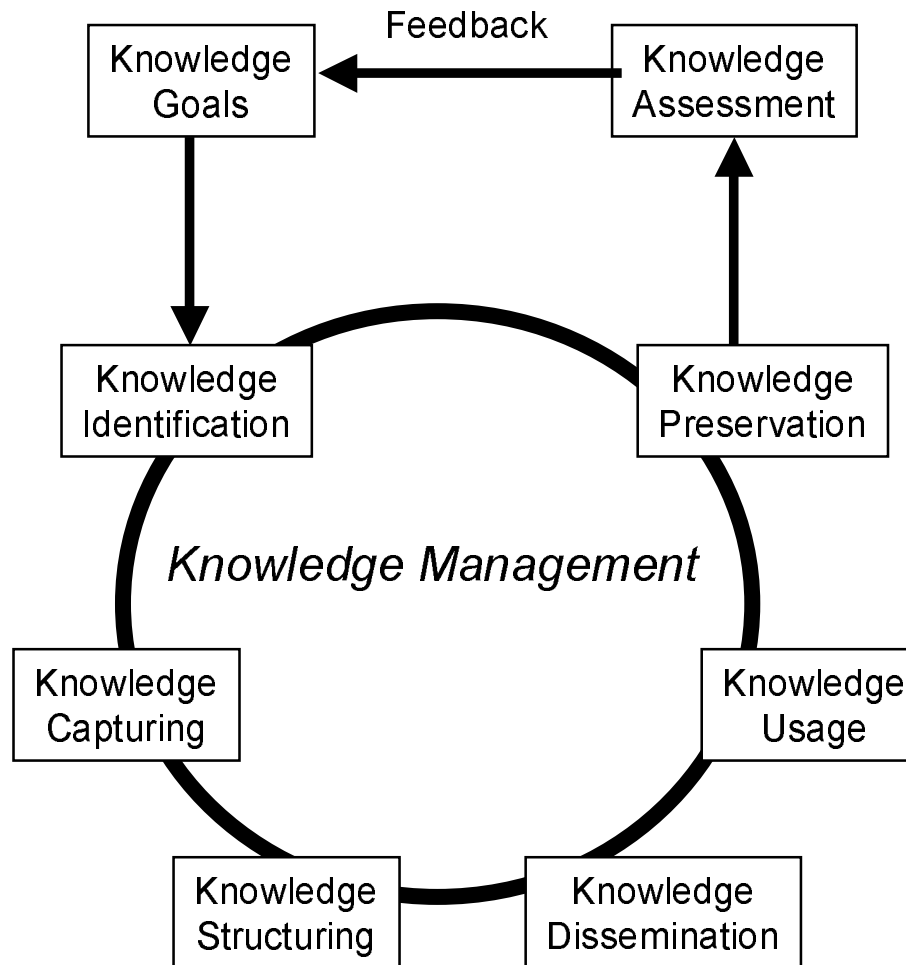
Goals of Knowledge Management

- Effective Utilization of the available Knowledge
- Knowledge Sharing and Reuse
- Accessibility of Knowledge
- Embedding of Knowledge in the Work Context

1.2 Introduction to Knowledge Management

Knowledge Management Process

[Probst et al. 1999]



Knowledge Goals: Determine Goals for KM Activities

Knowledge Identification: Create Overview about available Knowledge

Knowledge Structuring: Structuring and Integration of Knowledge

Knowledge Capturing: Acquisition of Knowledge

Knowledge Dissemination: goal oriented dissemination of Knowledge

Knowledge Usage: productive Usage of Knowledge for the Company

Knowledge Preservation: Storage and Maintenance of Knowledge

Knowledge Assessment: Assessment of current Knowledge and compliance with goals

1.2 Introduction to Knowledge Management

Viewpoints on KM

- Management
 - Define Knowledge Goal
 - Asses Knowledge
 - Hire Employee
 - Change corporate culture
 - Employee Skill Management...

- Information Technology
 - Organizational Memory Information Systems
 - Intranets
 - Information Retrieval
 - Data Warehouse / Data Mining
 - Information Filtering/Agents
 - ...



1.2 Introduction to Knowledge Management

Several Views on Knowledge (I)

- Tacit Knowledge
 - Personal, Created by Experience
 - Intuition, Mental Models, not documented
- Explicit Knowledge
 - Documented
 - Reconstructable

1.2 Introduction to Knowledge Management

Several Views on Knowledge (II)

informal:

- E.g. ASCII-Text, Word-Document, Powerpoint-Presentation

semi-structured:

- informal representation is enriched with attributes
- Examples: XML, SGML, HTML, email

structured:

- Structured according to fixed set of attributes
- Example: (Text-)Database

formal:

- Examples: Frames, Production Rules, relational Database, Programm Code

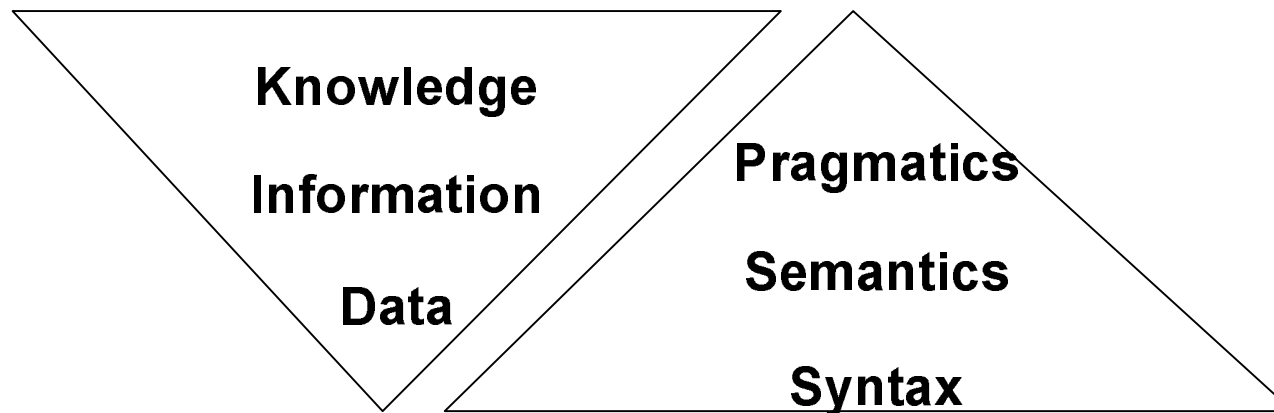
*human
readable*



*machine
readable*

1.2 Introduction of Knowledge Management

Several Views on Knowledge (III)



Knowledge Management as
Information Management in **Organizational Context**

1.2 Introduction of Knowledge Management

Organizational Memory

- Knowledge Dissemination, Knowledge Preservation
- Combination of several Techniques:
- Usual Motivation:
 - Document writing is (relatively) easy.
 - Knowledge often available in documents (manual, internal memos etc.)
- Principle:
 - instead of formalization of Knowledge, administer Organizational Memories
 - **Documents containing Knowledge in a human readable and understandable form.**
 - **Knowledge Maps (Skills etc.)**
e.g. (Text-)Databases, Document-Mgmt Systems, Intranet (Hypermedia)
 - Structuring of Knowledge simplifies search and usage, e.g. by
 - **Classification of Documents/ Indexing, Case Based Reasoning**
- Problem: Link to applications

1.2 Introduction of Knowledge Management

From Objectives to Intelligent Techniques

Organization & People

- Determine objectives
 - Identify Knowledge
 - Capture Knowledge
 - Structure Knowledge
 - Use Knowledge
 - Preserve Knowledge
 - Disseminate Knowl.
 - Assess Knowledge
 - Preserve Knowledge

General Data Processing

- Capture Data
- Maintain Data
- Process Data
- Integrate Data
- Search for Data
 - Use Data

AI Techniques

- Information Retrieval & Extraction
- Visualization Techniques
- Case-based Reasoning
 - Ontology-based KM
 - Meta data-based KM
- Knowledge Discovery
- (Knowledge Acquisition)



2 State-of-the-Industry

Everything is Knowledge Management??

„My car is my favorite KM tool, because I
always drive to my colleagues and my
clients in order to exchange knowledge!“

2 State-of-the-Industry

KM = Content Management + Volltextsuche?

KNOWLEDGE-MANAGEMENT-STUDIE

Anbieter	Produkt	Funktionale Bewertung (max. 19 Punkte)	Gesamt- ergebnis (max. 54 Punkte)	Web-Adresse
Arcplan	Insight/Dynasight 2.4	13	33	www.arcplan.de
Autonomy	KM-Suite 1.9	19	37	www.autonomy.com
Blue Angel	Metastar 2.1.3	16	30	www.blueangeltech.com
Dataware	Dataware II KM-Suite 2.0.4	19	46	www.dataware.com
Dr. Materna	Knowledge-Bridge/ Knowledge-Architect	13	43	www.materna.de
Excalibur	Retrievalware 6.7	16	35	www.excalib.com
Gauss Interprise	VIP 3.0	15	42	www.gauss.de
Grapevine	Grapevine for Compass Server 3.01B	15	34	www.grapevine.com
IDS Scheer	Enterprise Knowledge Portal (Betaversion)	12	37	www.ids-scheer.de
Opentext	Livelink 8.1.3	19	48	www.opentext.com
Pironet	Pirobase 4	16	41	www.pironet.com
SAP	Knowledge Warehouse	16	49	www.sap.de
Schema	Schematext	16	36	www.schema.de
USU	Knowledgeminer 2.2	16	35	www.usu.de
Verity	Knowledge Product Suite 3.6	15	39	www.verity.com
ZAP	Ucone 1.0.1	13	23	www.zapnet.de

Quelle: IT-Research (www.it-research.net).

2 State-of-the-Industry

A shot at categorization (subjective & highly incomplete!!!)

- *Information Retrieval*: Verity™, Connex™, Excalibur™, Eurospider™, Google™, Fulcrum™
- *Collaborative Filtering*: Grapevine™
- *Intranet Portal*: Intraspect™, Open Text™, Autonomy™, Ontoprise™
- *Groupware*: Lotus Notes™, MS Exchange™
- *Document Management*: PCDOCS™, InQuery™, Filenet™, Documentum™
- *Text Summarization*: Prosum
- *Database solutions*: Wincite™, Dataware™, Agentware™
- *Experience Factories*: at A.D.Little™, at Xerox™
- *Skill Management*: Loga HRMS (P&I)™, proprietary solutions
- *Semantic Nets-based*: USU™, Knowledge Park™
- *Visualization*: Inxight™, Administrator™
- *Knowledge Discovery*: Clementine™, IBM™, SAS™



Techniques for Knowledge Management

3 Techniques for Knowledge Management

Organization & People

- Determine objectives
 - Identify Knowledge
 - Capture Knowledge
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- Assess Knowledge
- Preserve Knowledge

General Data Processing

- Capture Data
- Maintain Data
- Process Data
- Integrate Data
- Search for Data
 - Use Data

Intelligent Techniques

- Information Retrieval & Extraction
- Visualization Techniques
- Case-based Reasoning
 - Ontology-based KM
 - Meta data-based KM
- Knowledge Discovery
- (Knowledge Acquisition)

3.1 Information Retrieval & Extraction

Organization & People

- Determine objectives
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General Data Processing

- Capture Data
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- Search for Data
 - Use Data

Intelligent Technique

- Information Retrieval & Extraction



3.1 Information Retrieval & Extraction

Main Objectives

- Find Knowledge
 - In unstructured/
semi-structured text
documents
- Capture Knowledge
 - Facts
 - Knowledge Structures
(Concepts, Relations)
- Use Knowledge

3.1 Information Retrieval & Extraction

Information Retrieval

- Find in repository
 - Keyword search
 - Keyword search with Thesaurus
 - Find similar documents / documents indexed by some label
 - **Vector Space Model (Vector of TF/IDF weights per doc)**
 - **Probabilistic Model (Binary Vector with Bayes)**
 - **Latent Semantic Analysis/Indexing (Deerwester et al.)**
 - Topic Spotting (in particular for Audio! Cf. Wiener et al.)
 - Summarization

(Sparck-Jones & Willett, 1997)

3.1 Information Retrieval & Extraction

Thesaurus - Objectives

- Map for a given field of knowledge
- Standard vocabulary for retrieval
- Unique terms for reference
- Locate new concepts in a scheme of relationships
- Broaden / narrow search through hierarchy

- Standardization of term usage

- Examples:
 - Roget's thesaurus,
 - WordNet / GermaNet / EuroWordnet
 - TEST (Thesaurus of Engineering and Scientific Terms), ...

3.1 Information Retrieval & Extraction

Thesaurus (Foskett 1980) - „**A treasury**“ of words

- Improve effectiveness of communication between people
- Constantly developing / Permanent revisioning
- Contents
 - Guidelines for form of terms (e.g. singular/plural)
 - Guidelines for relationships (BT, NT, RT)
- Administration:
 - Check consistency (dangling links?)
 - Maintain statistics (keep it as small as possible!!)
 - Acceptability of terms
 - Maintain records of term history

3.1 Information Retrieval & Extraction

IR in Context - Proactive Delivery

- Deliver similar web documents proactively
 - build index on metainformation of documents
 - metainformation: automatically extracted keywords, summary, document title, URL and date and time of access
 - Retrieval Modes:
 - **keyword**
 - **what's new?**
 - **comparison with user profile**
 - **comparison with group**
 - Retrieval Technique:
 - **Keyword**
 - **Possibilities: Vector Space Model, ...**

(Jasper; Davies et al. 1995)

3.1 Information Retrieval & Extraction

Capture Knowledge Contents

- Fact Extraction
 - Annotation/Metadata by hand
 - **Labeling with Keywords**
 - **Semantic Annotation** (Buitelaar et al. 2000; Decker et al. 1999)
→ Section on Metadata
 - Automated
 - **Automatic labeling of documents**
 - clustering
 - Latent Semantic indexing (problems with efficiency)
 - **Scisor (Rau 1988); ParseTalk (Hahn et al. 1999; Staab 1999)**
 - Semi-automated
 - **Information extraction proposing semantics** (Erdmann et al.)

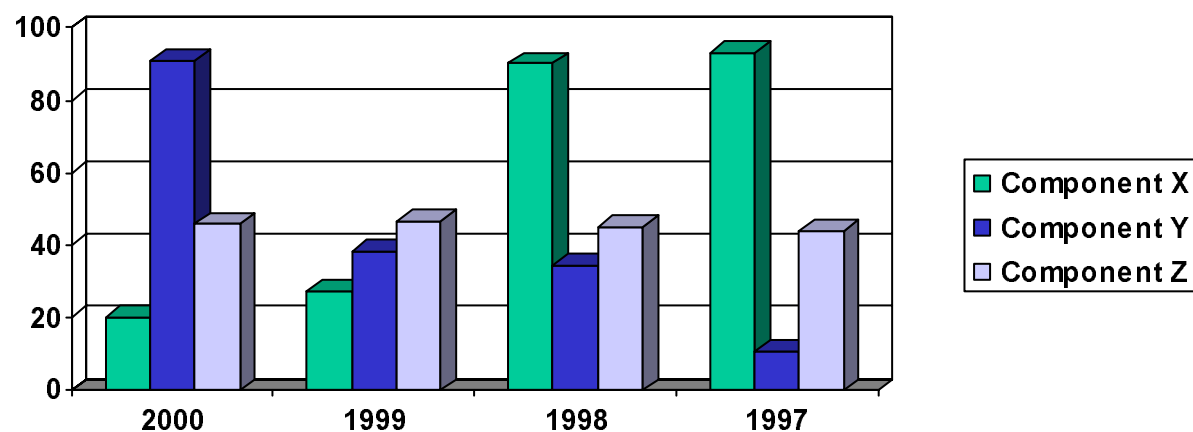
3.1 Information Retrieval & Extraction

Information Extraction

Case: Dow Chemicals

- Patent Analysis based on Information Extraction
- Extract degree expressions “10 tons of sulfur”
- Use OLAP/knowledge discovery (section to follow) to determine trends in use of chemicals

Qualitative Diagram:





3.1 Information Retrieval & Extraction

Capture Knowledge Structures

- Learning of hierarchical structures
 - Relevant Terms:
 - Justeson & Katz
 - Terminological Engineering/Learning from Text
 - Relevant Relations
 - Faure et al.
 - Mädche & Staab



3.2 Case-based Reasoning

Importance of Lessons Learned

„Human experts are not systems of rules, they are libraries of experiences.“

Riesbeck & Schank 1989

3.2 Case-based Reasoning

Lessons Learned

Organization & People

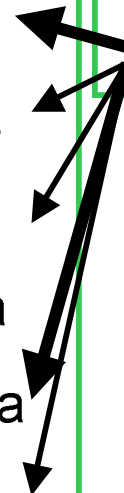
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General Data Processing

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- Process Data
- Integrate Data
- Search for Data
- Use Data

Intelligent Technique

- Case-based Reasoning



3.2 Case-based Reasoning

Motivation & Process

Motivation:

- Knowledge Documents (e.g. Project Report)

General CBR Process:

- RETRIEVE cases similar to current problem
- REUSE retrieved cases
- REVISION proposed solution (improve/correct)
- RETAIN new knowledge

Knowledge Containers

- Case base (collection)
- Vocabulary used to describe cases
- Similarity measure
- Adaption model for revision

(Kolodner 1993),
(Lenz et al. 1998)

3.2 Case-based Reasoning

Textual Case-based Reasoning

“Know How Documents”

- FAQ Finder: Burke et al. 1997
- Automatic hotline for Siemens technicians (Lenz 1998)
(human hotline as backup)
- In-house configuration management of LHS AG (Lenz 1998)
- Aircraft maintenance at British Airways (Magaldi 1999)

3.2 Case-based Reasoning

FAQ Finder Help

About FAQ Finder

Supported
FAQs

System
Status

FAQFINDER

Please Enter a natural language question to be answered.
(for example, "Who is Lila Feng?")
FAQfinder is not a search engine; do not enter keywords

Is downshifting a good way to slow down my car?

Find Answer!

Clear Question

☐ Quick Match

☐ Merge Related FAQs

(© Burke et al. 1997)

3.2 Case-based Reasoning

FAQFINDER

[FAQ Finder Help](#)[About FAQ Finder](#)

Question: Is downshifting a good way to slow down my car?

Pick A FAQ

[Rephrase Question](#)
[Manually Choose FAQ](#)

 autos_consumer_FAQ
 car_audio_FAQ
 bicycles_FAQ
 locksmithing_FAQ

☐ Define Unknown Words

(© Burke et al. 1997)



3.2 Case-based Reasoning

FAQFINDER

[FAQ Finder Help](#) [About FAQ Finder](#)

Question: Is downshifting a good way to slow down my car?
File: autos_consumer_FAQ

[View Entire FAQfile](#)
[Rephrase Question](#)
[Select Different FAQ](#)
[Start Over!](#)

- [They tell me I should downshift when braking to slow my car down. Is this really a good idea?](#)
It used to be a very good idea, back in the days of medi...
- [What about DOT-5 brake fluids?](#)
This breaks down in to two parts. The DOT-5 specifi...
- [How often should I replace my brake fluid?](#)
Probably more often than you do. Traditional brake flui...
- [Can I rotate radials from side to side, or rotate them only on one side of my car?](#)
Car and tire manufacturers have differing views on this ...
- [How many snow tires should I buy, and if I buy 2, which end of the car should I put them on?](#)
In short, 4, and both ends. To explain, many drivers in...

(© Burke et al. 1997)

3.2 Case-based Reasoning

FAQFINDER

[FAQ Finder Help](#)[About FAQ Finder](#)[Previous Question](#)[Next Question](#)[View Entire FAQfile](#)[Rephrase Question](#)[Start Over!](#)

File: autos_consumer_FAQ

They tell me I should downshift when braking to slow my car down. Is this really a good idea?

It used to be a very good idea, back in the days of mediocre, fade prone drum brakes. In modern disc brake equipped cars, use of downshifting to slow the car is not really necessary, except in cases of long, steep downhill runs. Otherwise, modern disc brakes are more than adequate to stop a passenger car in all circumstances, and they are much cheaper to repair than clutch linings.

On the other hand, many standard driver's license tests in the USA still specify that the driver being tested downshift under braking; I suggest that before taking a US driver's test, you either 1) learn to do this smoothly (which takes some time and practice) or 2) borrow a car with an automatic to take the test.

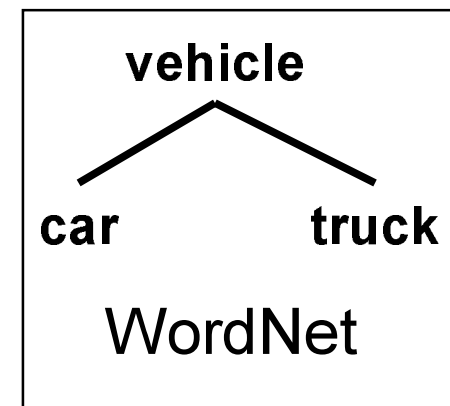
(© Burke et al. 1997)

3.2 Case-based Reasoning

FAQ Finder Techniques

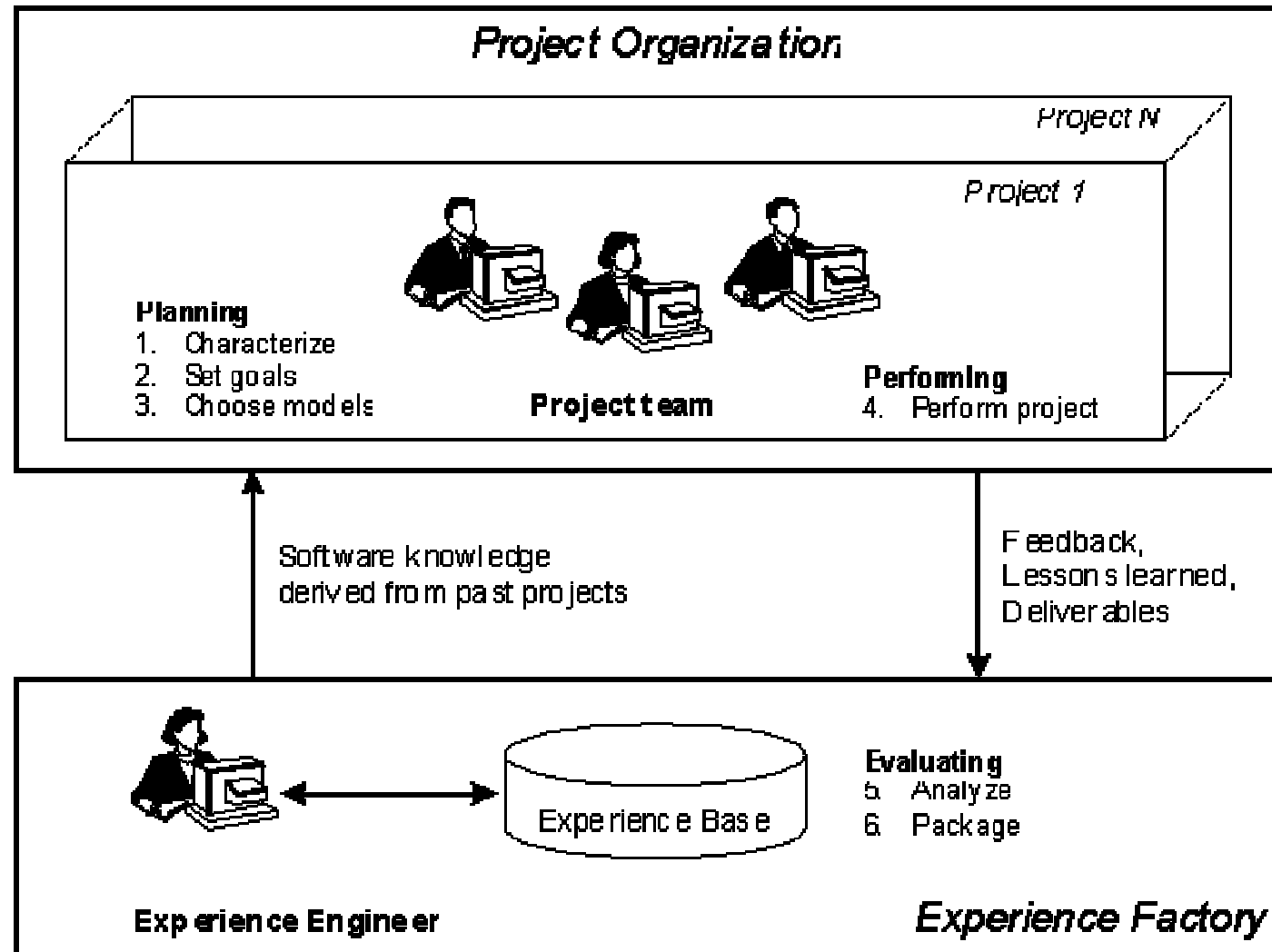
Matching User Query with QA pairs in FAQ file:

- Statistics model
 - Vector space model: term vectors with *tfidf* values
 - $tfidf = n * \log(M/m)$
(term frequency inverse document frequency)
- Semantic model
 - Word by word comparison of user question and FAQ questions
 - using marker passing in WordNet
 - punish for words that are not matched
- No syntactic model



3.2 Case-based Reasoning

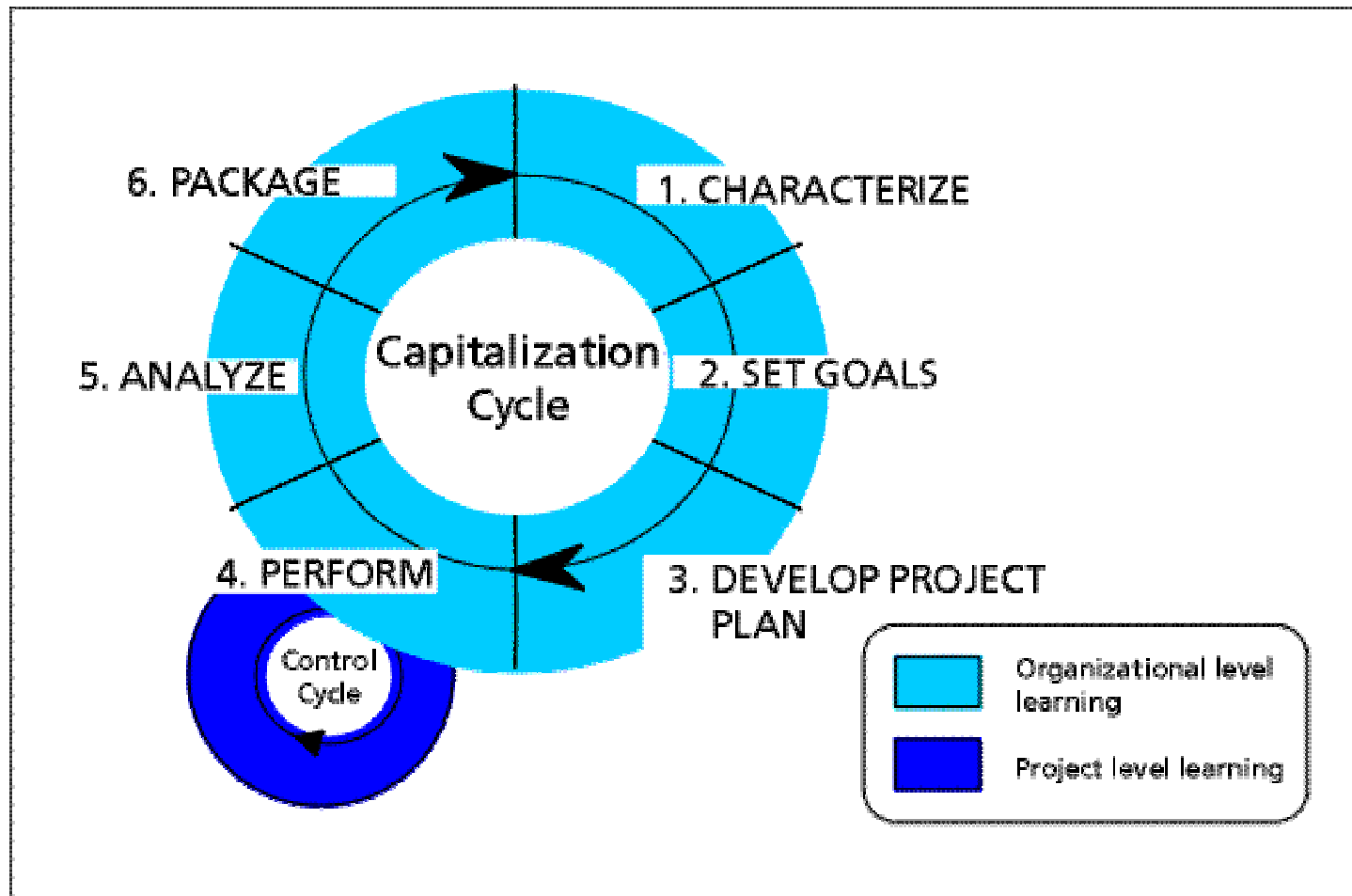
Software Experience Factory (Basili et al. 1992)



(© Althoff et al. 1998)

3.2 Case-based Reasoning

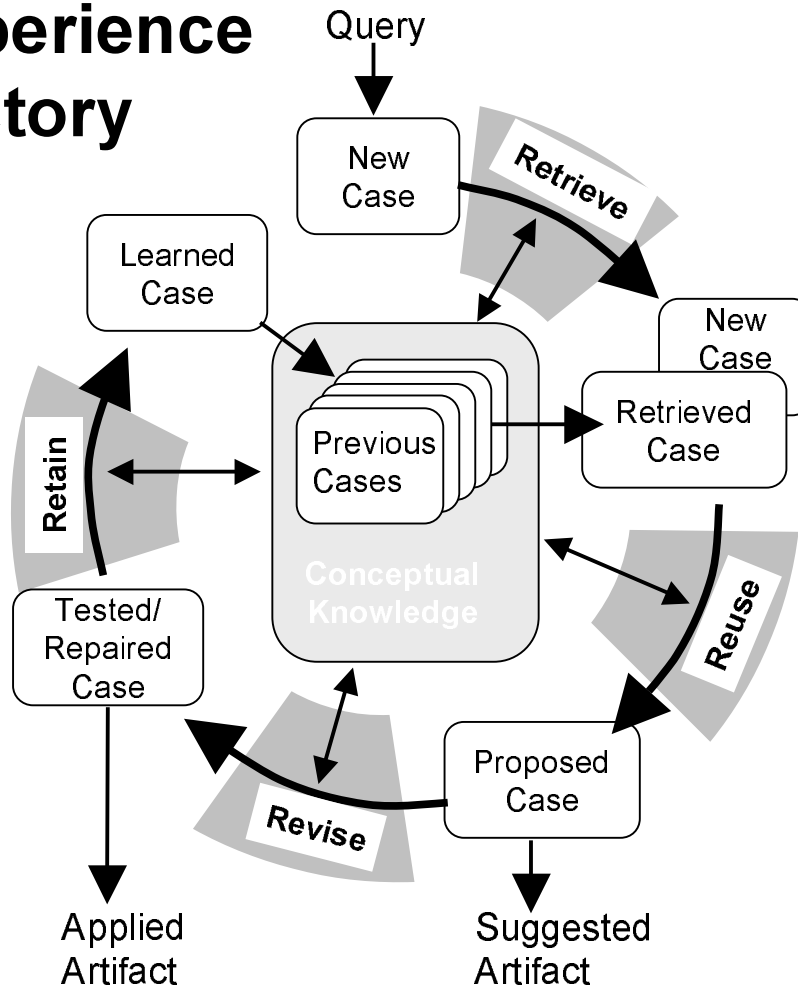
Software Experience Factory



(© Althoff et al. 1998)

5 Case-based Reasoning

Experience Factory



Case := Problem
(characterization)/solution (artifact) pair

Query: Query at hand defines new case (problem without solution)

Retrieve: New case is used to find most similar case among the known (previous) cases

Reuse: New and retrieved case are combined to a proposed case including the suggested artifact

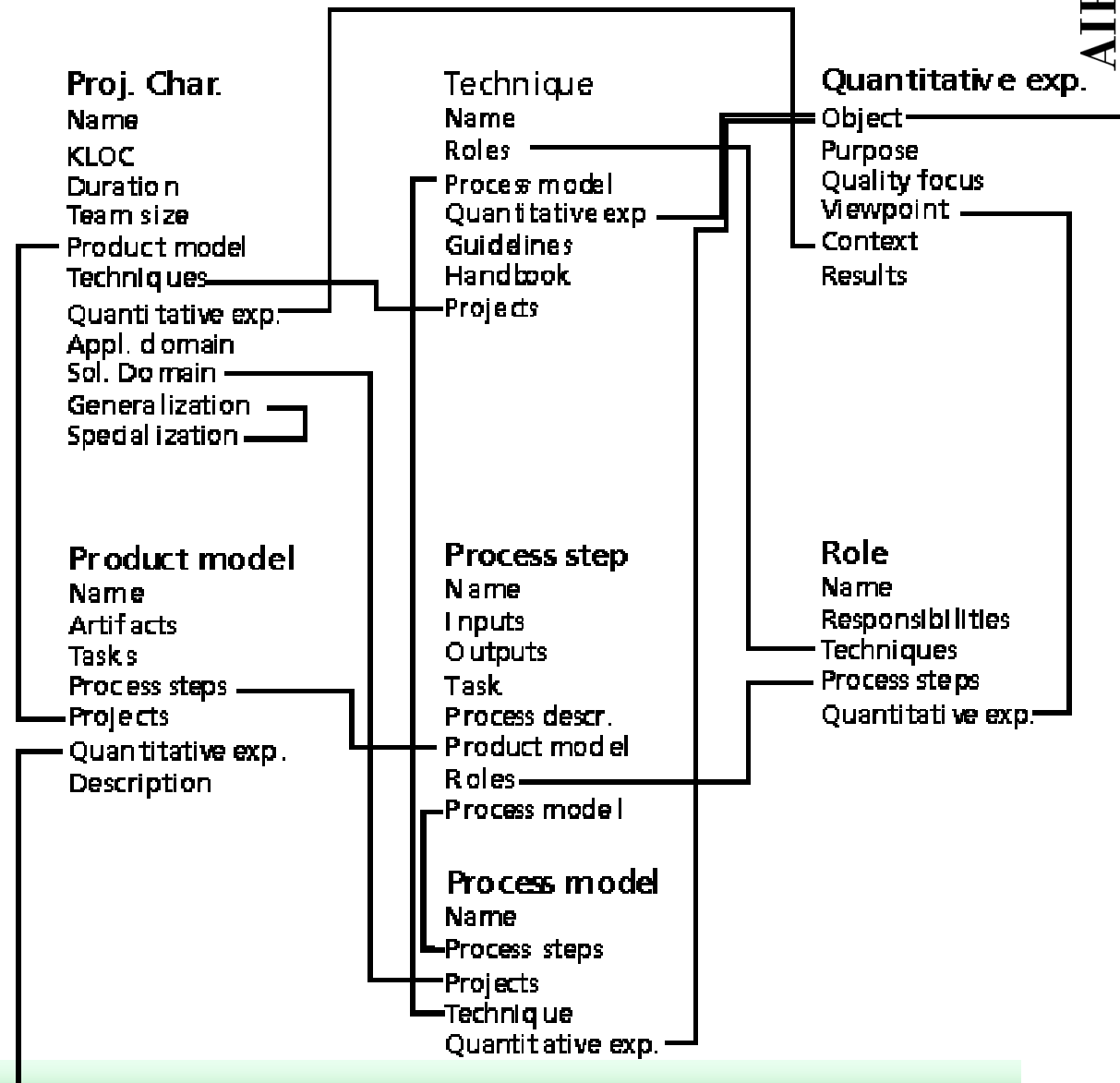
Revise: Suggested artifact is applied and evaluated

Retain: Useful experiences from applying the artifact are retained by adapting the case base and the conceptual knowledge

(© Althoff et al. 1998)

3.2 Case-based Reasoning

Software Experience Factory

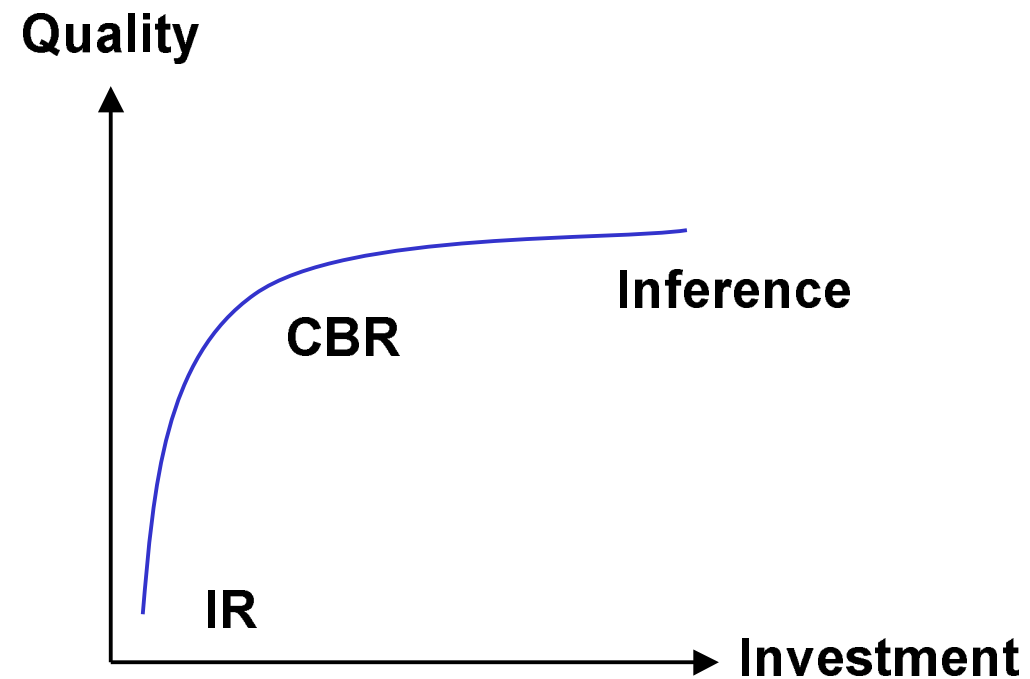


(© Althoff et al. 1998)

3.2 Case-based Reasoning

Conclusion on CBR

- Domain modeling important, but also expensive
- Commercially successful
- Claim



3.3 Knowledge Discovery

Aggregating Knowledge out of Data

- Creating knowledge out of data: KDD, Machine Learning *per se* (Tutorial by Fayyad & Simoudis 97)
- Creating knowledge out of knowledge
 - Learn T-Box from A-Box: Kietz & Morik 94
 - Learn terminology from texts: Staab et al. (eds.) 2000
- Knowledge discovery/Data analysis as a **collaborative process**
 - Collaboration: Ackermann & Mandel 99; Staudt et al. 98
 - CRISP-DM Process Model: Chapman et al. 99
- Directing attention / User interface issues:
 - Collaborative filtering (e.g. Goldberg et al. 1992, Resnick et al. 94)
 - User adaptation (e.g. Syskill & Webert, Pazzani et al. 96, 97)

3.3 Knowledge Discovery

Organization & People

- Determine objectives
 - Identify Knowledge
 - Capture Knowledge
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General Data Processing

- Capture Data
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 - Use Data

Intelligent Technique

- Knowledge Discovery



3.3 Knowledge Discovery

CRISP - KD as a process

Business Understanding	Data Understanding	Data Preparation	Modeling	Evaluation	Deployment
Determine Business Objectives <i>Background</i> <i>Business Objectives</i> <i>Business Success Criteria</i>	Collect Initial Data <i>Initial Data Collection Report</i>	<i>Data Set</i> <i>Data Set Description</i>	Select Modeling Technique <i>Modeling Technique</i> <i>Modeling Assumptions</i>	Evaluate Results <i>Assessment of Data Mining Results w.r.t. Business Success Criteria</i> <i>Approved Models</i>	Plan Deployment <i>Deployment Plan</i>
Assess Situation <i>Inventory of Resources</i> <i>Requirements, Assumptions, and Constraints</i> <i>Risks and Contingencies</i> <i>Terminology</i> <i>Costs and Benefits</i>	Describe Data <i>Data Description Report</i>	Select Data <i>Rationale for Inclusion / Exclusion</i>	Generate Test Design <i>Test Design</i>	Review Process <i>Review of Process</i>	Plan Monitoring and Maintenance <i>Monitoring and Maintenance Plan</i>
Determine Data Mining Goals <i>Data Mining Goals</i> <i>Data Mining Success Criteria</i>	Explore Data <i>Data Exploration Report</i>	Clean Data <i>Data Cleaning Report</i>	Build Model <i>Parameter Settings</i> <i>Models</i> <i>Model Description</i>	Determine Next Steps <i>List of Possible Actions</i> <i>Decision</i>	Produce Final Report <i>Final Report</i> <i>Final Presentation</i>
Produce Project Plan <i>Project Plan</i> <i>Initial Assessment of Tools and Techniques</i>	Verify Data Quality <i>Data Quality Report</i>	Construct Data <i>Derived Attributes</i> <i>Generated Records</i>	Assess Model <i>Model Assessment</i> <i>Revised Parameter Settings</i>		Review Project <i>Experience</i> <i>Documentation</i>
		Integrate Data <i>Merged Data</i>			
		Format Data <i>Reformatted Data</i>			

Generic Tasks (bold) and Outputs (italic) of the CRISP-DM Reference Model

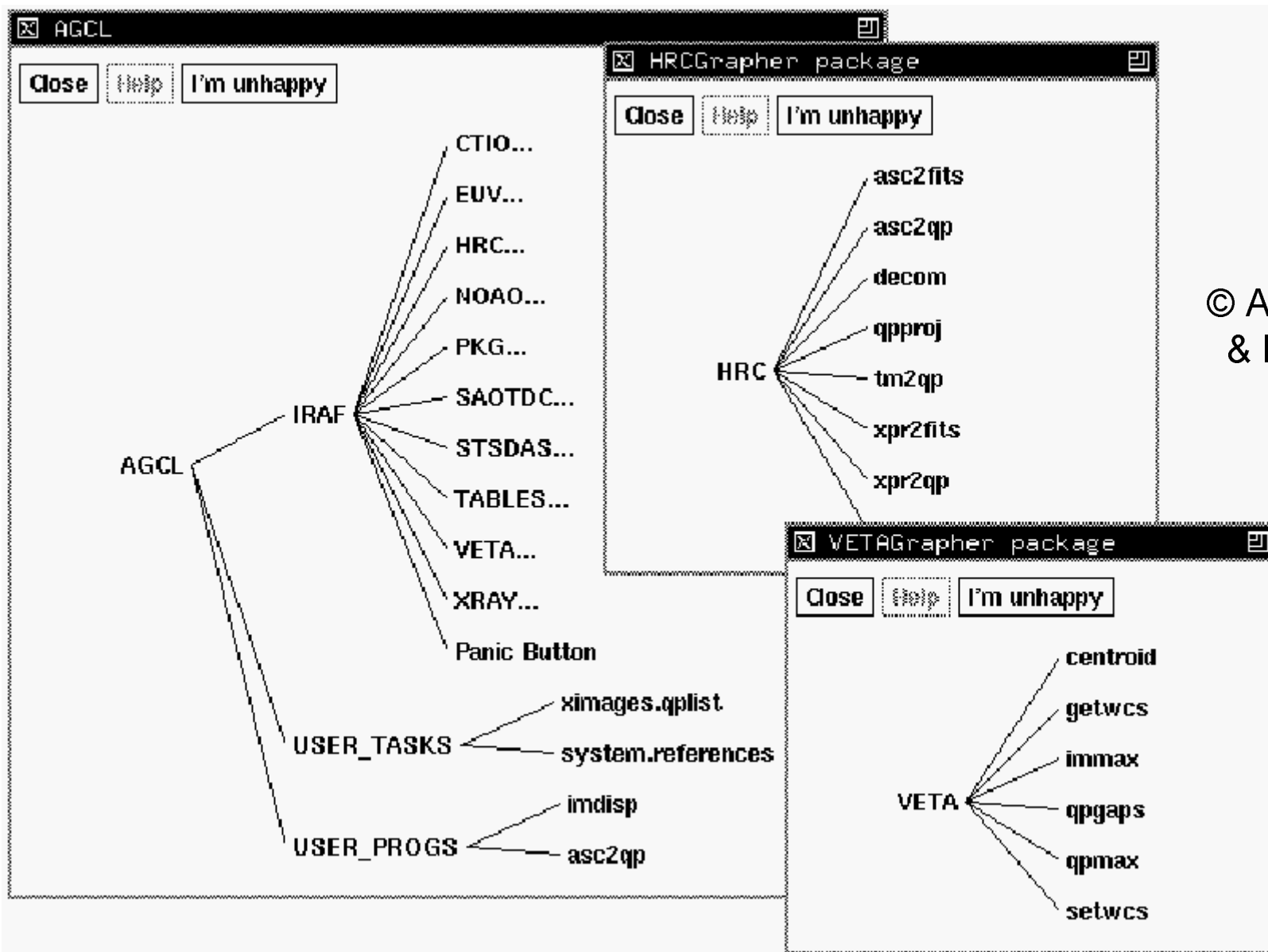
3.3 Knowledge Discovery

Task-Based Organizational Memory

- ASSIST (OM for task of analysing astronomical data)
- Problem description
 - given: lots and lots of raw data in different formats
 - given: plenty of analysis tools building on different formats
- Objective: reuse tools and methodological knowledge
- Solution: OM centered around
 - data, software, other information
 - uniform, flexible, extensible interface

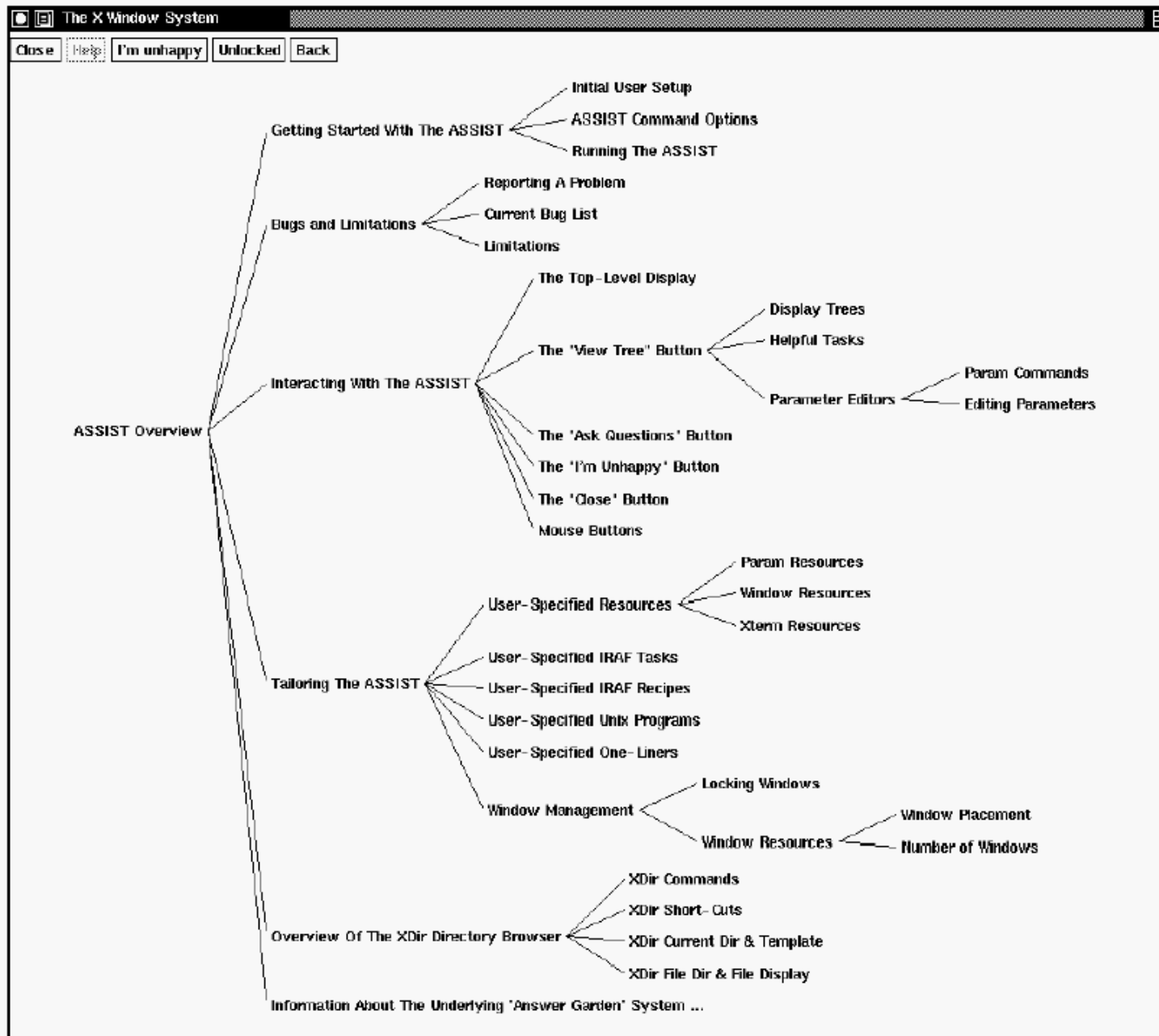
(Ackerman & Mandel 99)

3.3 Knowledge Discovery - Task-based OM



© Ackerman
& Mandel,
1999

3.3 Knowledge Discovery - Task-based OM



© Ackerman
& Mandel,
1999

3.3 Knowledge Discovery

Improve Sharing of Knowledge

Collaborative filtering of usenet news

- Let users score articles
- Predict scores of an unread articles depending on how your profile matches with other people who rated this article (no interference with content!)

- Example:

message	Ken	Lee	Meg	Nan
#1	1	4	2	2
#2	5	2	4	4
#3			3	
#4	2	5		5
#5	4	1		1
#6	?	2	5	?

- Technical gimmick: exploit usenet structure to distribute ratings
(Resnick et al. 1994; <http://www.movielens.umn.edu/>)

3.3 Knowledge Discovery

Predict Scores

- Determine Correlation Coefficient
 - +1 perfect agreement**
 - 0 no correlation**
 - 1 perfect disagreement**

$$\chi_{XL} := \text{cov}(X, L) / (\sigma_X \sigma_L)$$

Estimate rating:

**Combine scores
according to χ_{XL}
(Resnick et al. 1994)**

- Use Singular Value Decomposition (LSI)
(Billsus & Pazzani, 1998)

- RankBoost:
Determine ranks for ratings

Combine many weak learners into a strong learner by changing the distribution along the way in order to improve on wrong choices

Each weak learner is simply a single user's opinion that does the best ranking given the actual distribution
(Freund et al. 1998)

3.3 Knowledge Discovery

Syskill & Webert

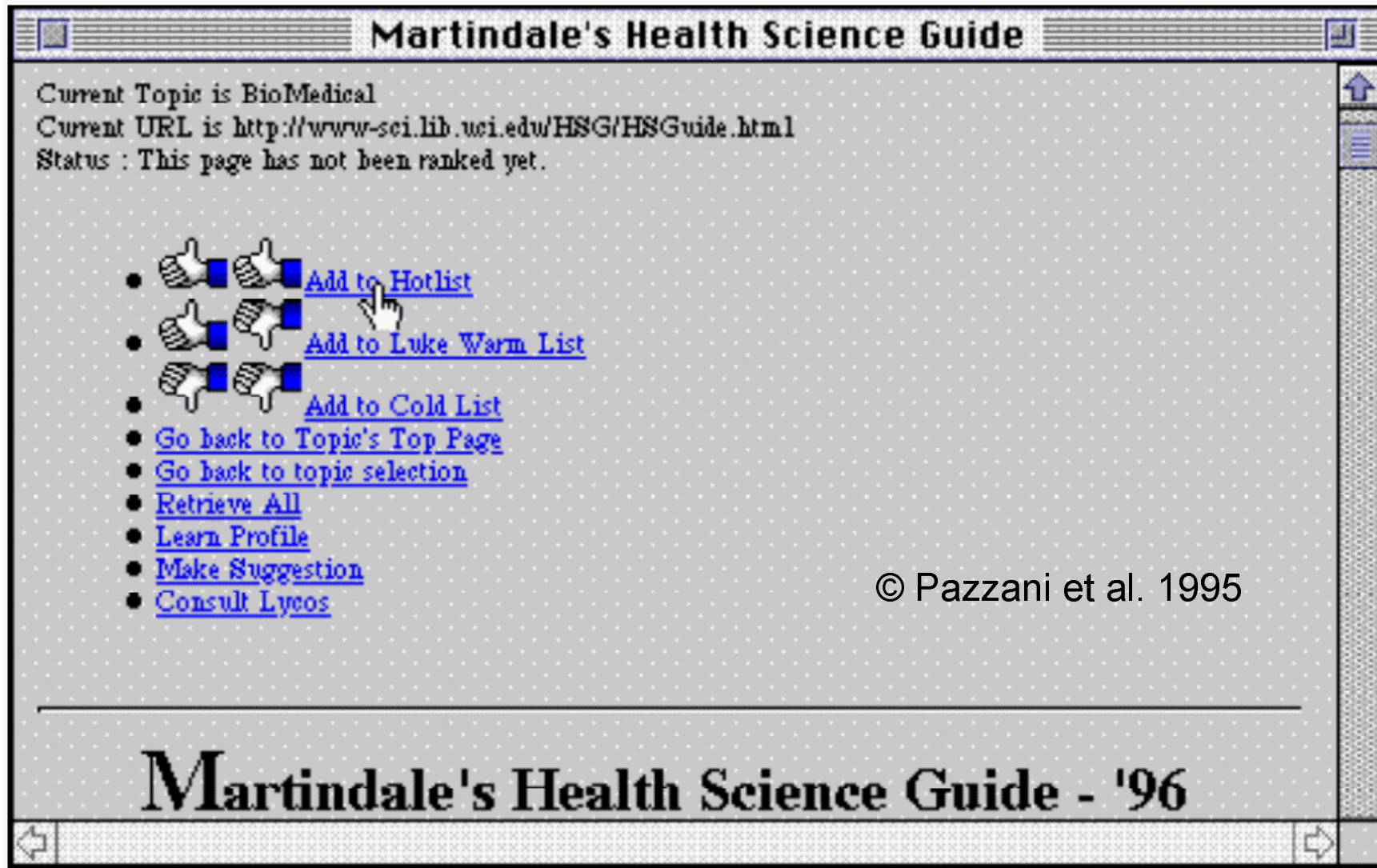
- Rank pages accessible from current page



- Learn relevance from input:
 - Word vectors (selection of relevant words)
 - user-defined words indicating (un-)interestingness,

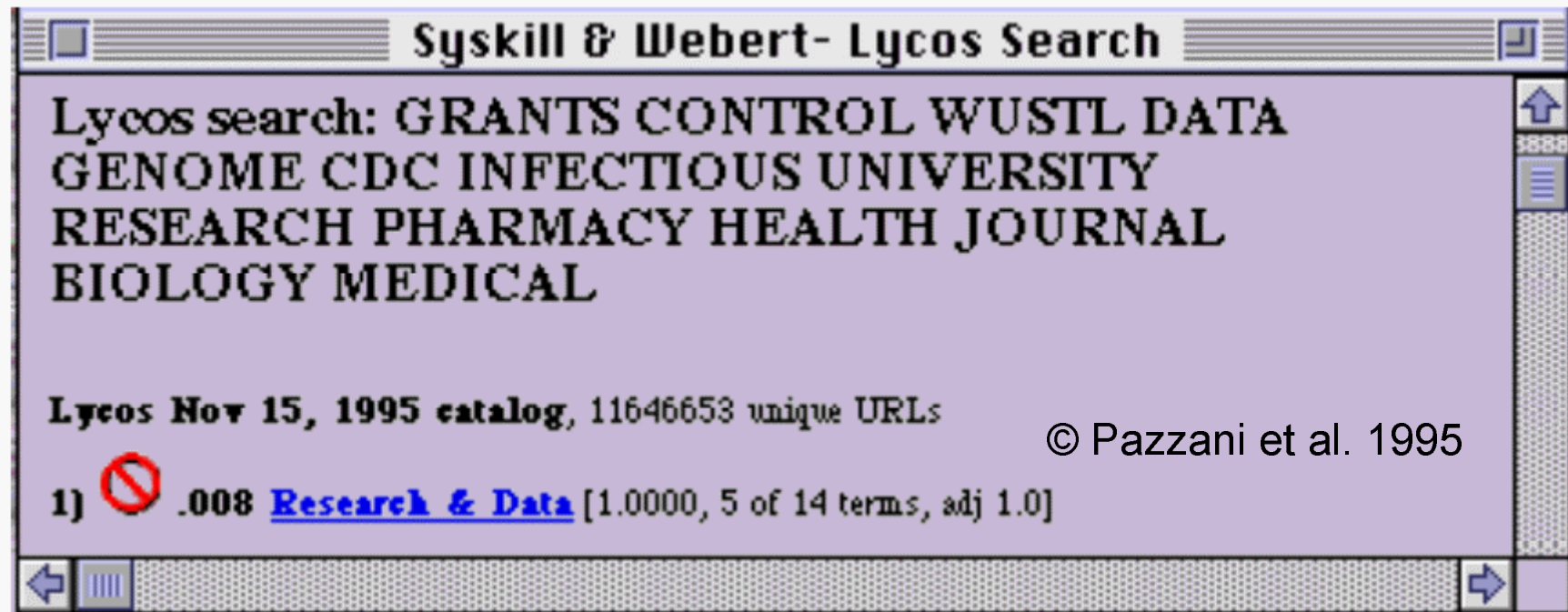
3.3 Knowledge Discovery

Syskill & Webert



3.3 Knowledge Discovery

Syskill & Webert

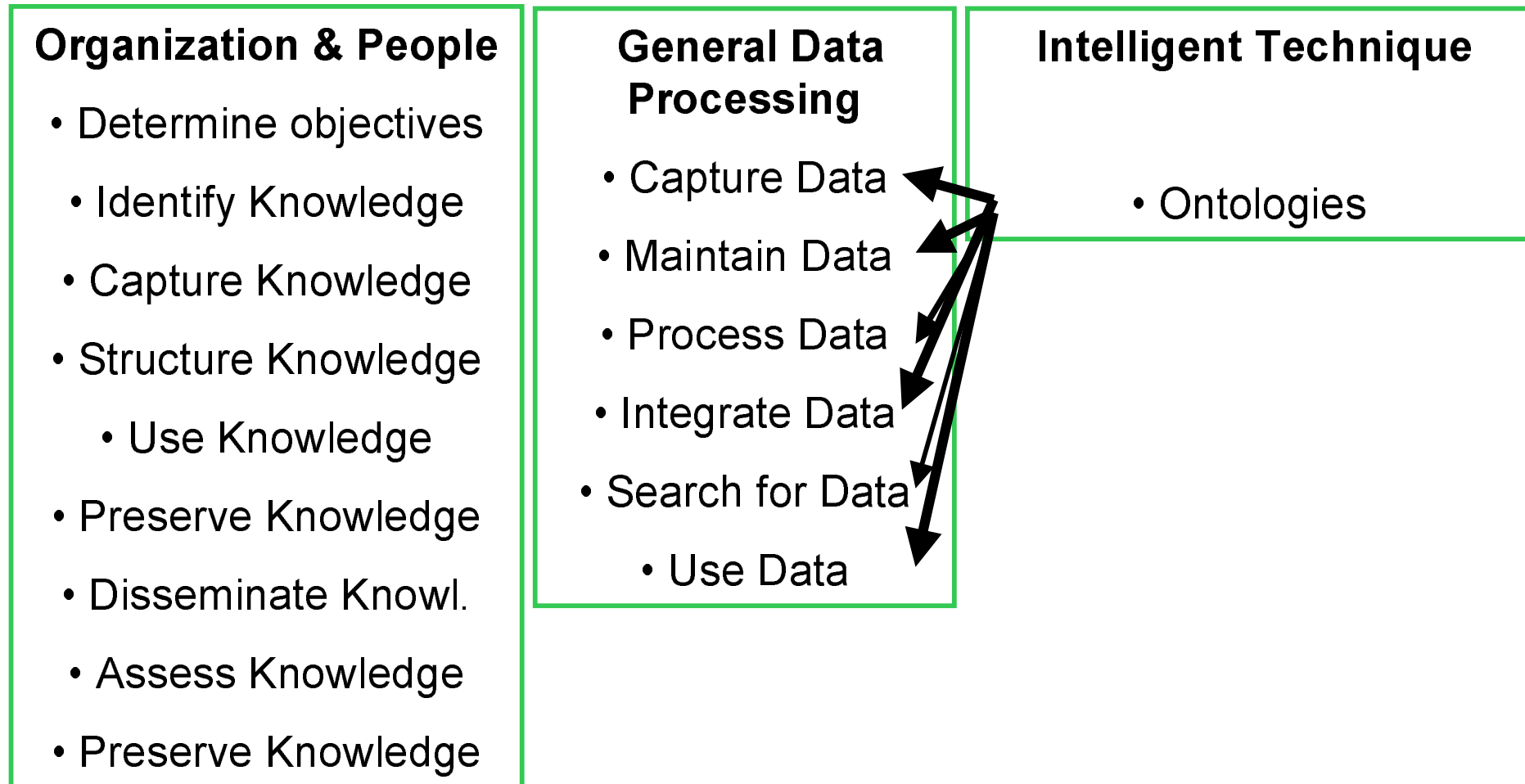


- Evaluation of Learning Algorithms
 - Bayes & Rocchio pretty good



Ontology-based Knowledge Management

3.4 Ontology-based Knowledge Management



3.4 Ontology-based Knowledge Management

Plan

- The Shape: Motivation
- The Skeleton: Framework
- The Meat: Ontology-based Tools for KM

3.4 Ontology-based Knowledge Management

Factors of Production

Capital

Land

**Effective and
Efficient
Use!**

Labour

Knowledge



3.4 Ontology-based Knowledge Management

Eff-Use of Knowledge

Capital

Land

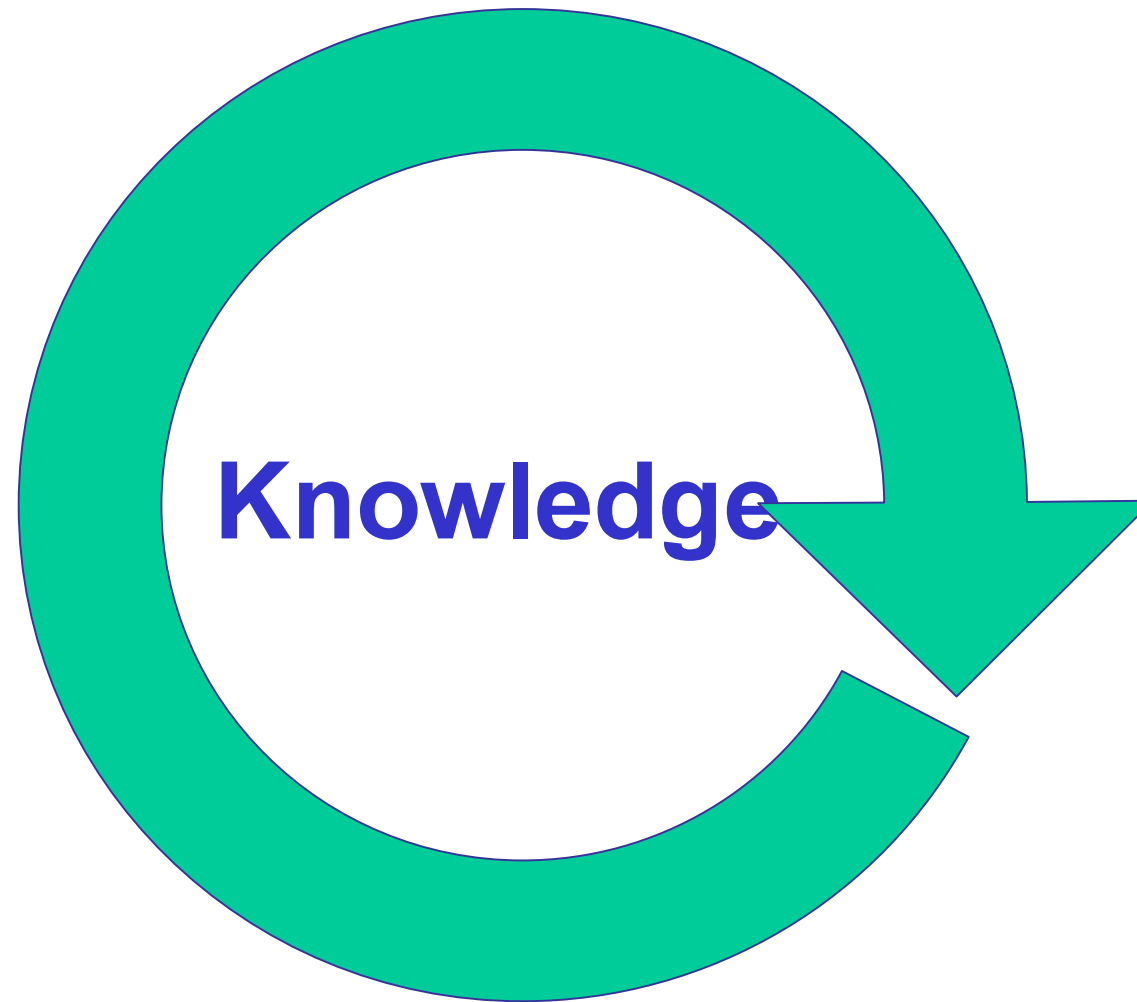
Knowledge



Labour

3.4 Ontology-based Knowledge Management

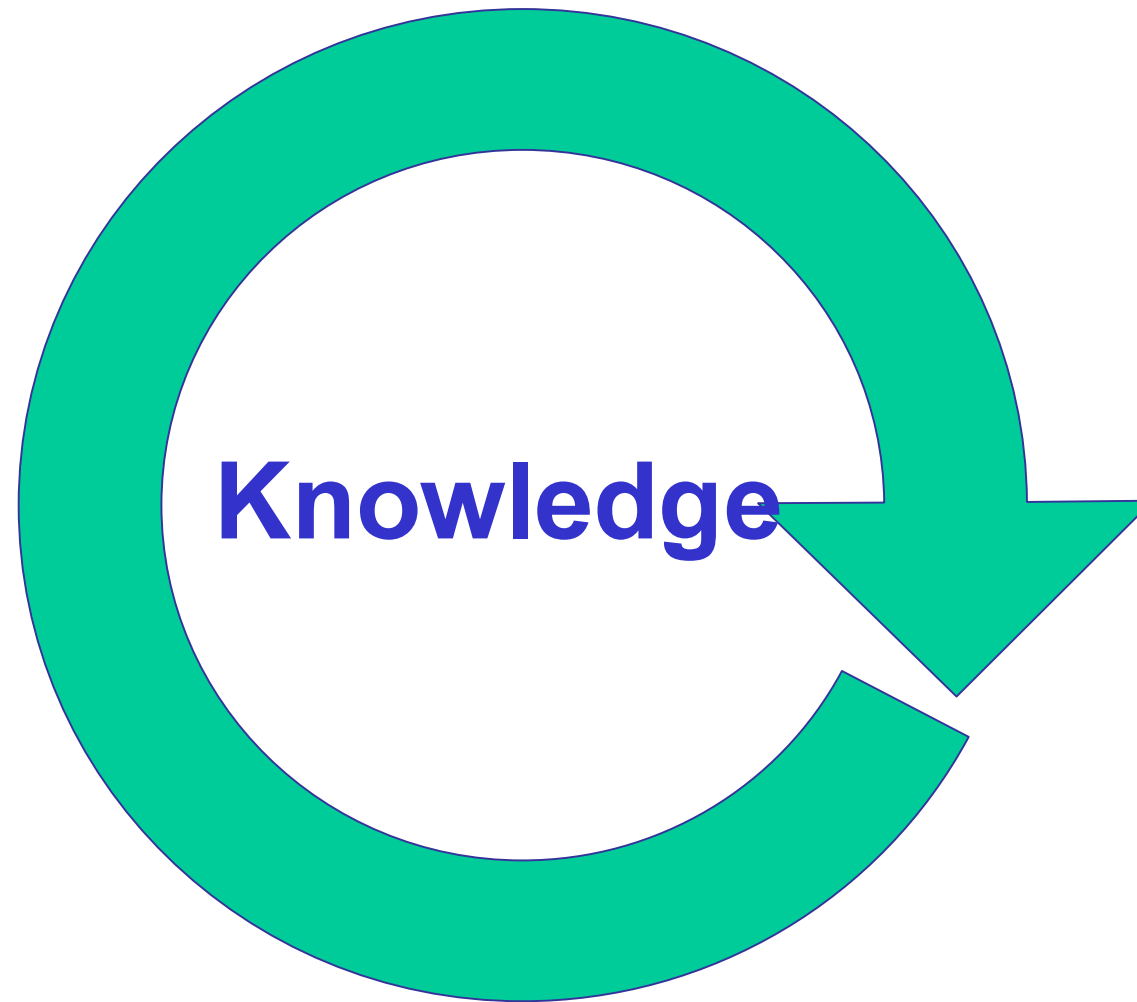
Eff-Use of Knowledge





3.4 Ontology-based Knowledge Management

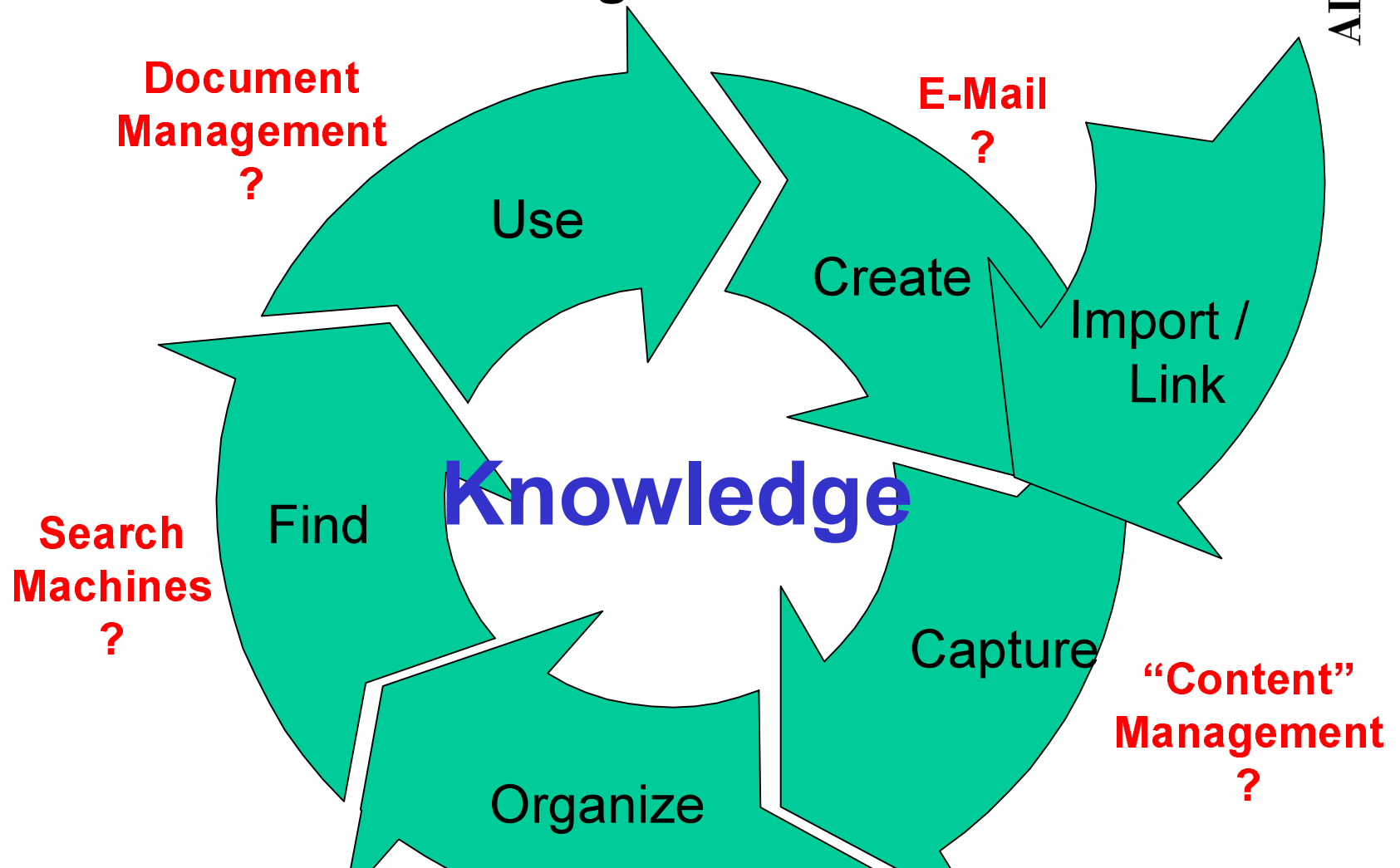
Improve Knowledge Life Cycle





3.4 Ontology-based Knowledge Management

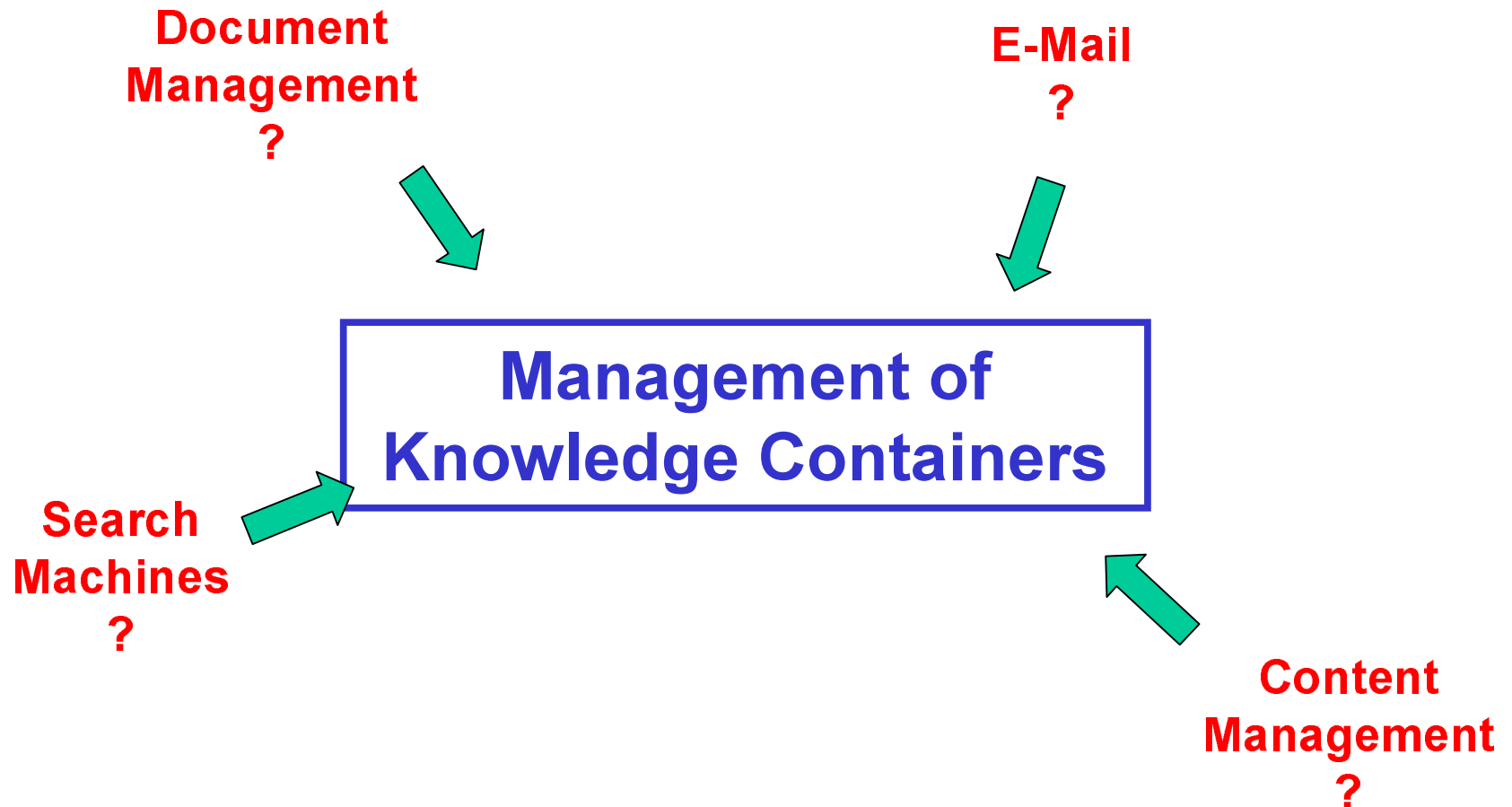
Subtasks of Knowledge Processes



Don't forget the overall process!

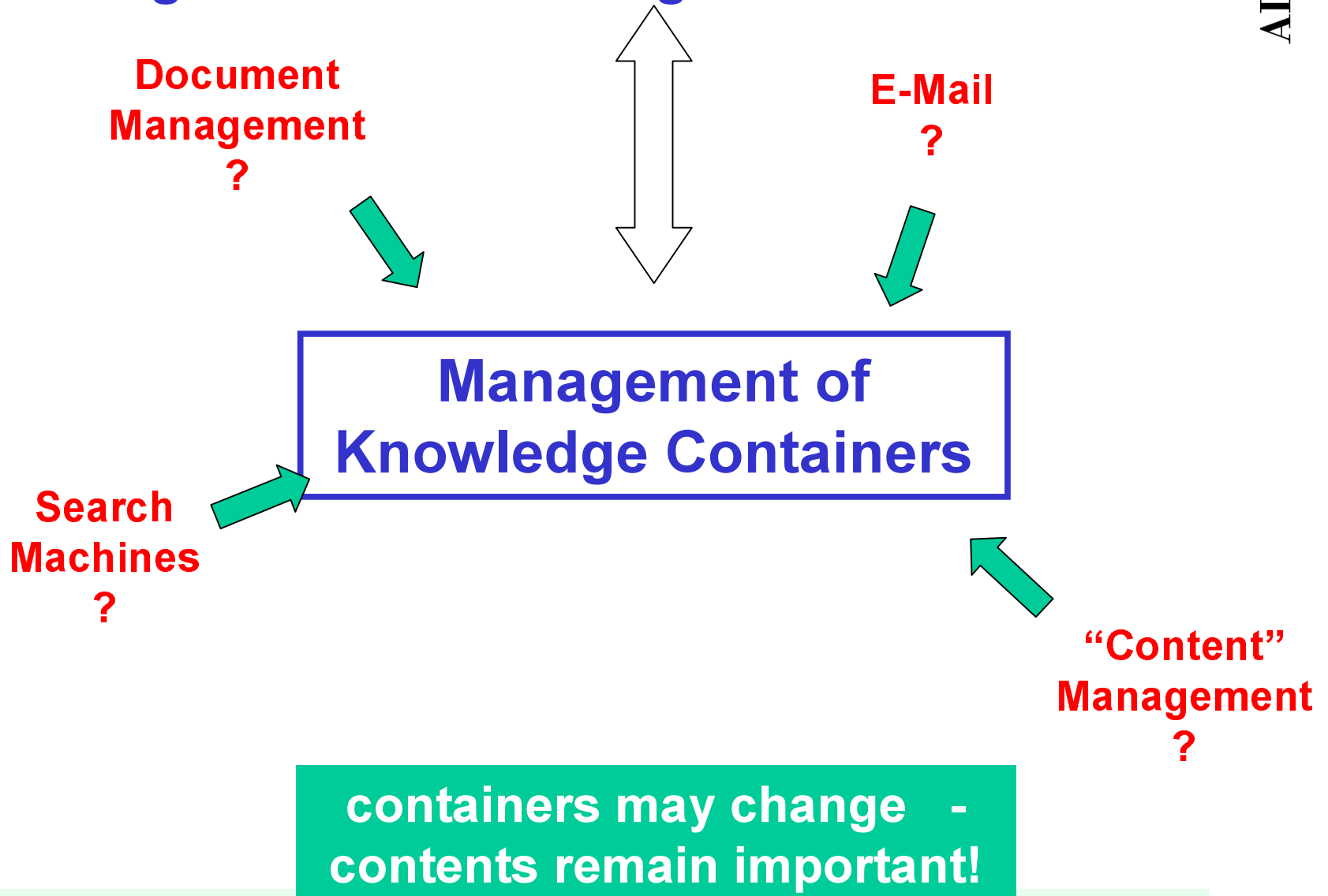
3.4 Ontology-based Knowledge Management

Subtasks of Knowledge Processes



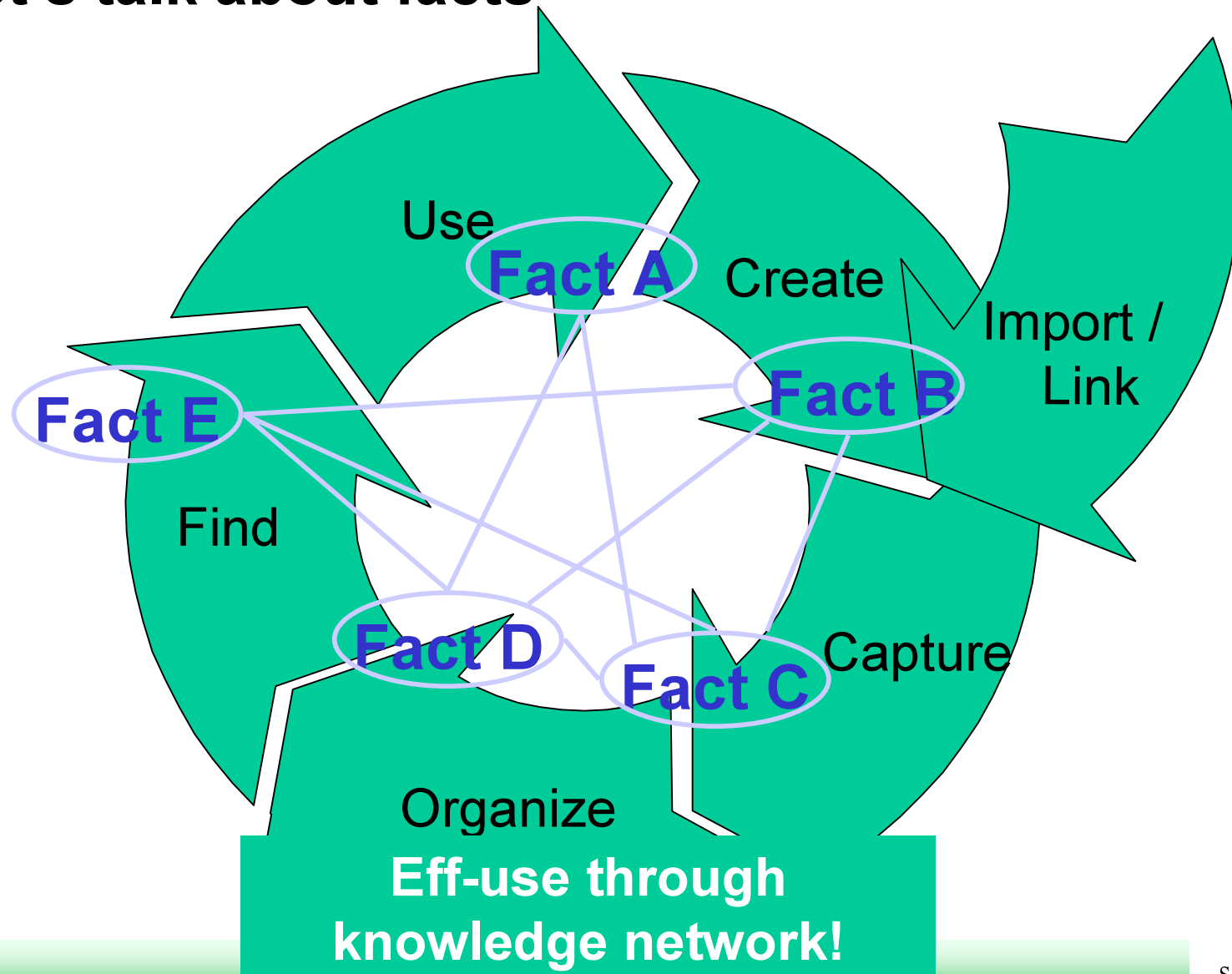
3.4 Ontology-based Knowledge Management

Management of Knowledge Contents



3.4 Ontology-based Knowledge Management

Let's talk about facts



3.4 Ontology-based Knowledge Management

Ontology



+ Axioms

+ Other Relations

+ Taxonomy

+ Concepts

An ontology (in our sense) is ...

...a formal specification

⇒ executable

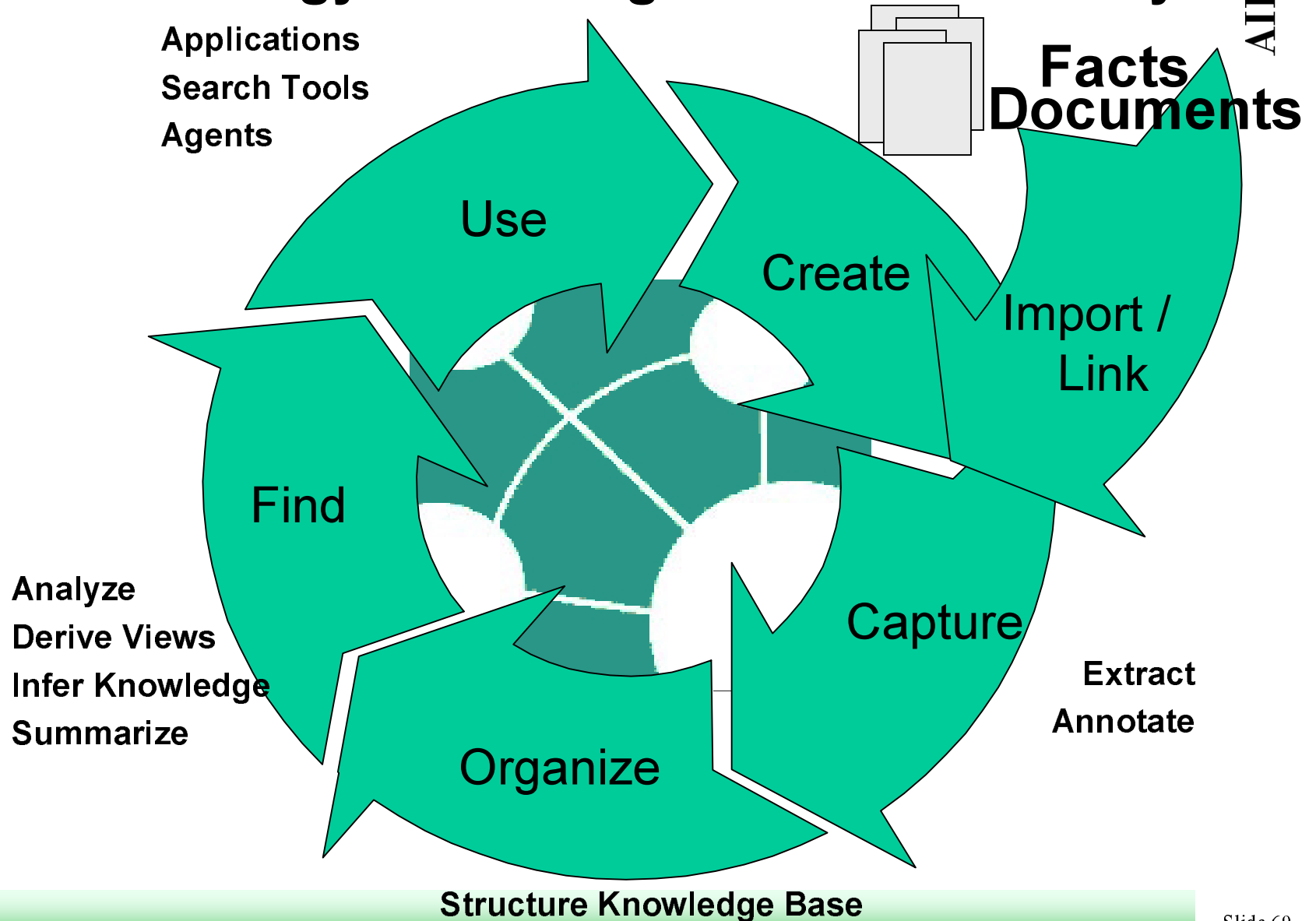
...of a shared conceptualization

⇒ group of people

...of some part of the world that is of interest ⇒ application

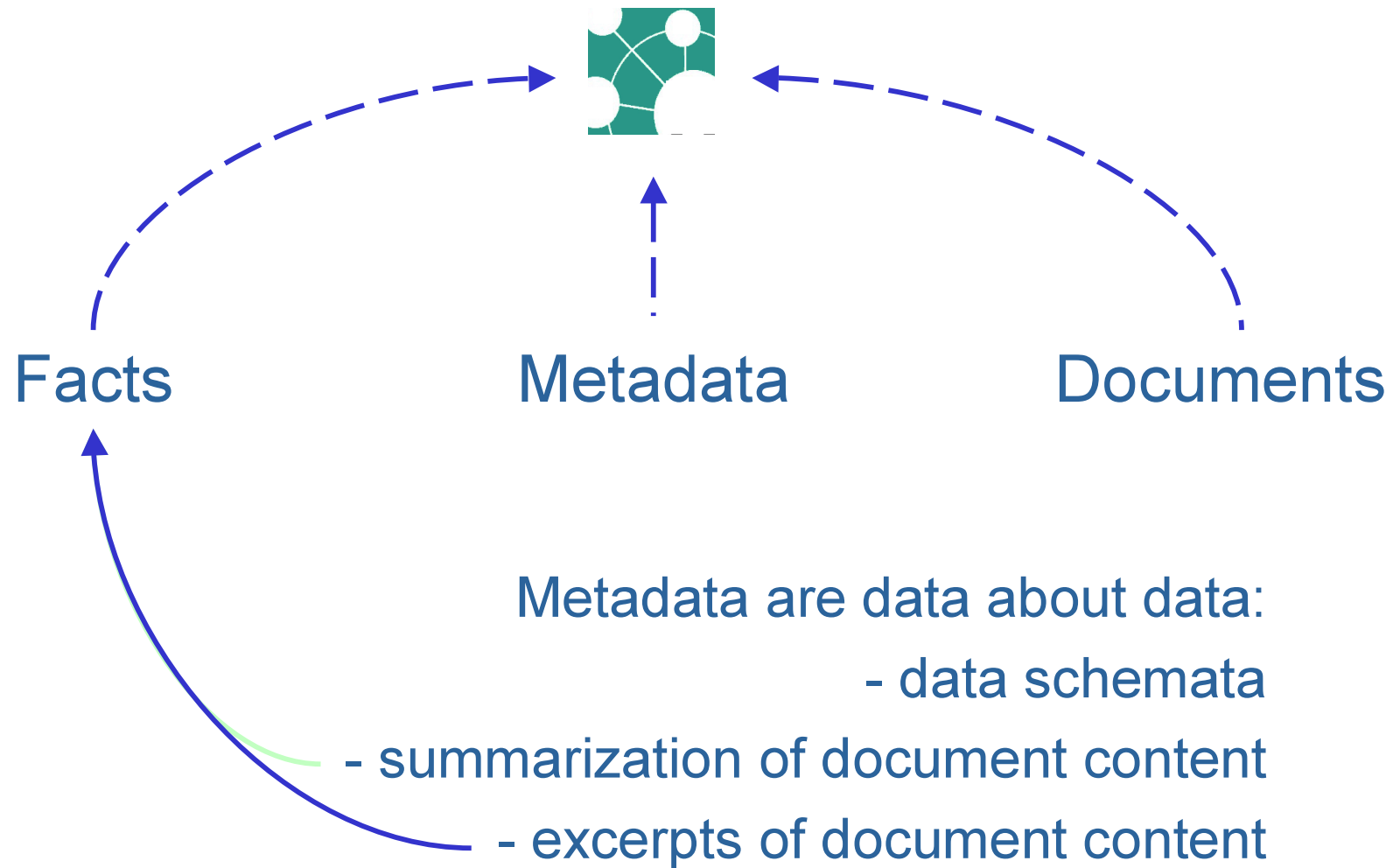
3.4 Ontology-based Knowledge Management

An Ontology-based Organizational Memory



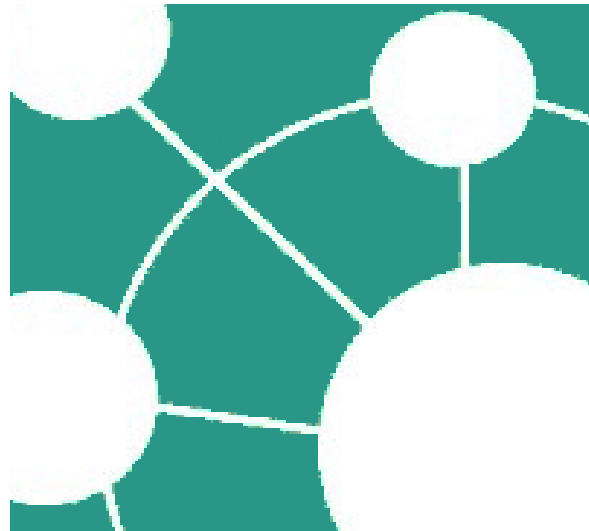
3.4 Ontology-based Knowledge Management

What about Documents?

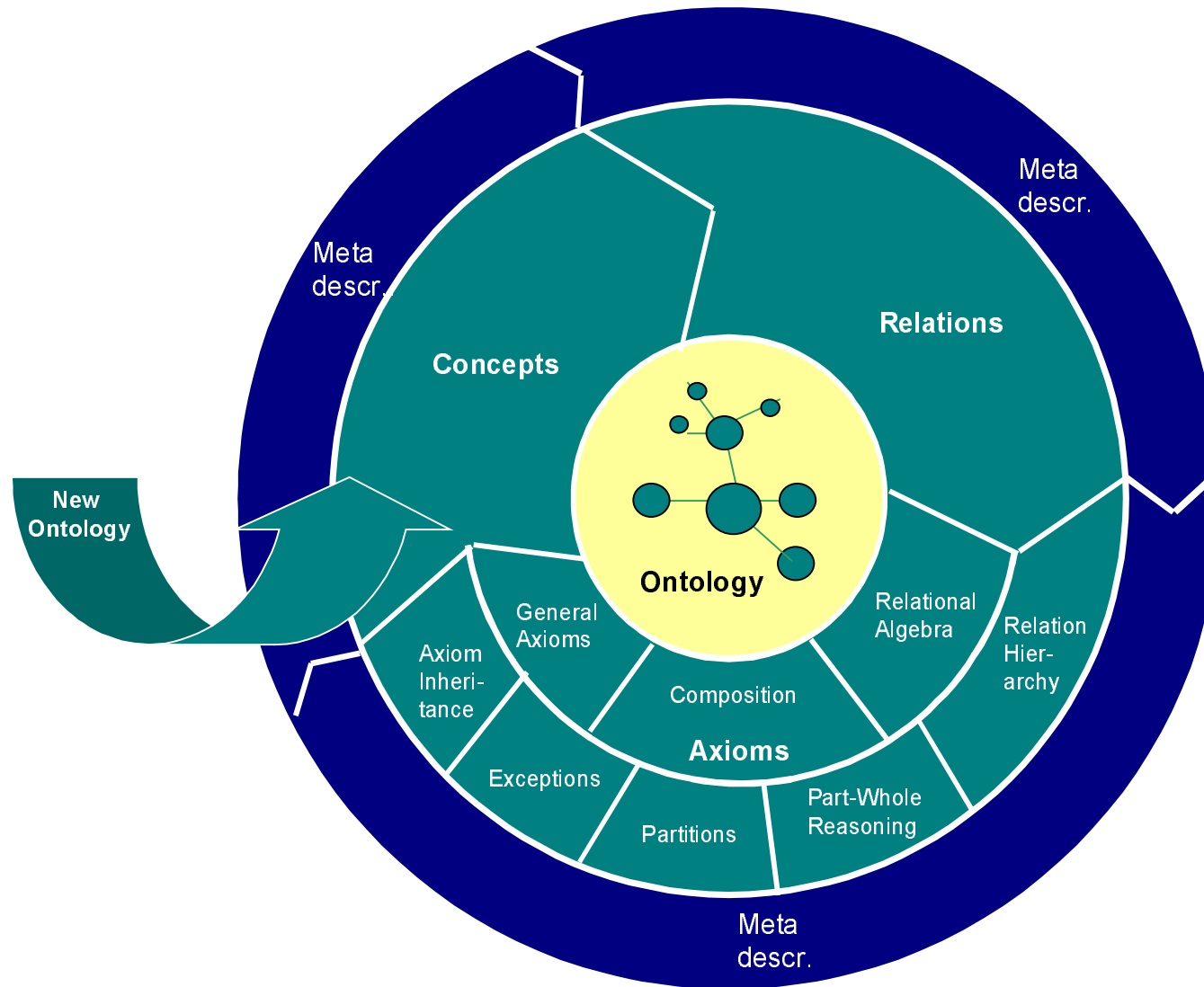


3.4 Ontology-based Knowledge Management

Our Ontology-based OM (or „meat to the skeleton“)



3.4 Ontology-based Knowledge Management Structure - Ontology Engineering



3.4 Ontology-based Knowledge Management

Structure - OntoEdit

The screenshot displays the OntoEdit software interface for the GETESS Tourism Ontology 3.0. The main window shows a hierarchical tree structure of the ontology. The 'Edit Tourist' dialog is open, showing the 'Concept ID' as 'Tourist', 'Instantiation' as 'Concrete', and 'External Representation' with two entries: 'de' (Urlauber) and 'en' (tourist). The 'Relations of Person' window is also visible, listing various properties and their domains. The 'Relation Axiom Frame' window shows a table of relations with their domains, ranges, and types.

GETESS Tourism Ontology 3.0 Structure:

- Root
 - Ding
 - Materielles_Ding
 - Persoennliches_Ding
 - Teilweise_Materielles_Ding
 - Kunstwerk
 - Lebewesen
 - Person
 - Agent
 - Angestellter
 - Arbeitende_Person
 - Baby
 - Betreiber
 - Enkel
 - Erwachsener
 - Fahrer
 - Frau
 - Gast
 - Geschaeftsleute
 - Geschwister
 - Gourmet
 - Grosseltern
 - Jugendlicher
 - Junge
 - Kind
 - Maedchen
 - Mann
 - Musiker
 - Reisefuehrer
 - Rentner
 - Schauspieler
 - Selbststaendiger
 - Sportler
 - Tourist
 - Veranstalter
 - Tier
 - Organisation
 - Pflanze
 - Immaterielles
 - Massen_Konzept
 - Mathematisches_Konzept

Edit Tourist Dialog:

Concept ID: Tourist

Instantiation: Concrete

External Representation:

Language	External Represe...
de	Urlauber
en	tourist

Relations of Person:

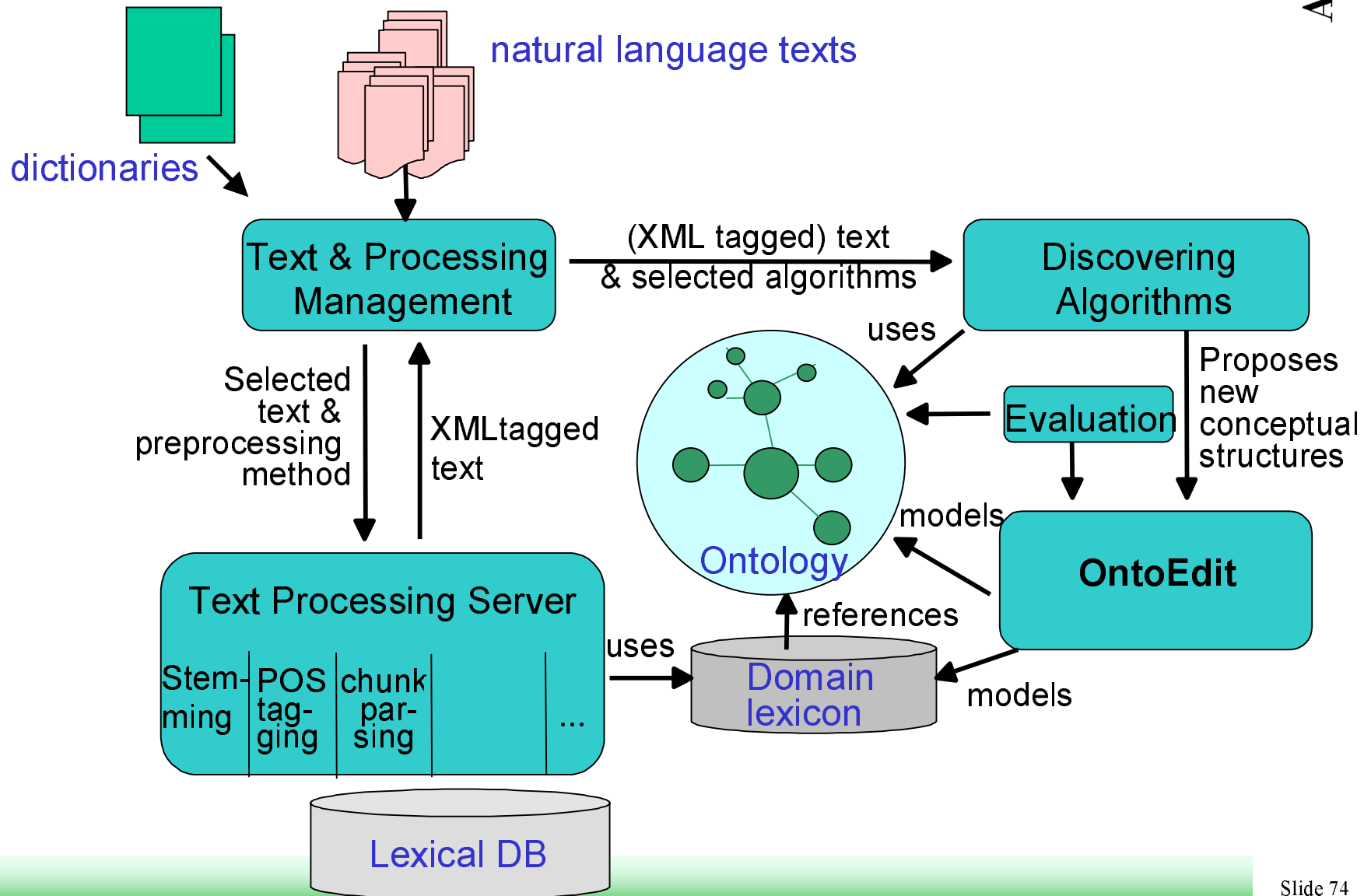
Name	Domain
hat_Oertlichkeit	STRING
Geburtsdatum	Raemliches_Konzept
Nachname	Datum
Vorname	STRING
besitzt_MatDing	STRING
besitzt_PersDing	Materielles_Ding
hat_Adresse	Persoennliches_Ding
istVerwandMit	Adresse
	Person

Relation Axiom Frame:

Relation	Domain	Range	Type	Comment
istVerwandMit	Person	Person	symmetric	
liegt_neben	Gebiet	Gebiet	symmetric	
grenzt_an	Flaeche	Flaeche	symmetric	
kooperiert_mit	Reiseveranstalter	Reiseveranstalter	symmetric	
ist_verbunden_mit	Verkehrsweg	Verkehrsweg	symmetric	
istVerwandMit	Person	Person	transitive	
liegt_in	Gebiet	Gebiet	transitive	

3.4 Ontology-based Knowledge Management

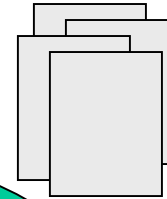
Structure - Ontology Learning





3.4 Ontology-based Knowledge Management

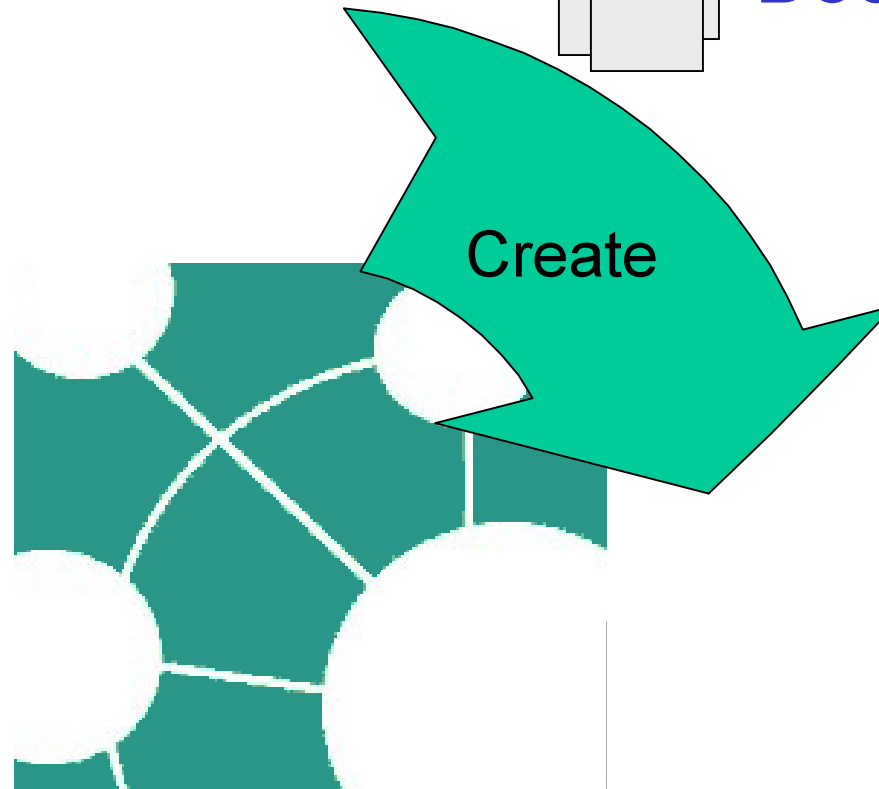
Our Ontology-based OM



**Facts
Documents**



AIFB



3.4 Ontology-based Knowledge Management

Create - Using Templates

```
<project>
<author>          </author>
<plandate>        </plandate>
<participants>
                  <member>          </member>
</participants>
<Ganttchart>      </Ganttchart>
<tasks>
                  <task>            </task>
</tasks>
</project>
```

3.4 Ontology-based Knowledge Management

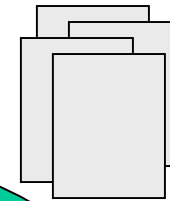
Create - Using Templates

<project>			
<author>		Jill Dole	</author>
<plandate>		October 18th, 1999	</plandate>
<participants>			
	<member>	Jill Dole	</member>
	<member>	Hans-Peter Schnurr	</member>
	<member>	Steffen Staab	</member>
</participants>			
<Ganttchart>		here goes the table	</Ganttchart>
<tasks>			
	<task>	Analysis of Nordic Life Business Processes	</task>
	<task>	Analysis of Nordic Life IT environment	</task>
</tasks>			
</project>			



3.4 Ontology-based Knowledge Management

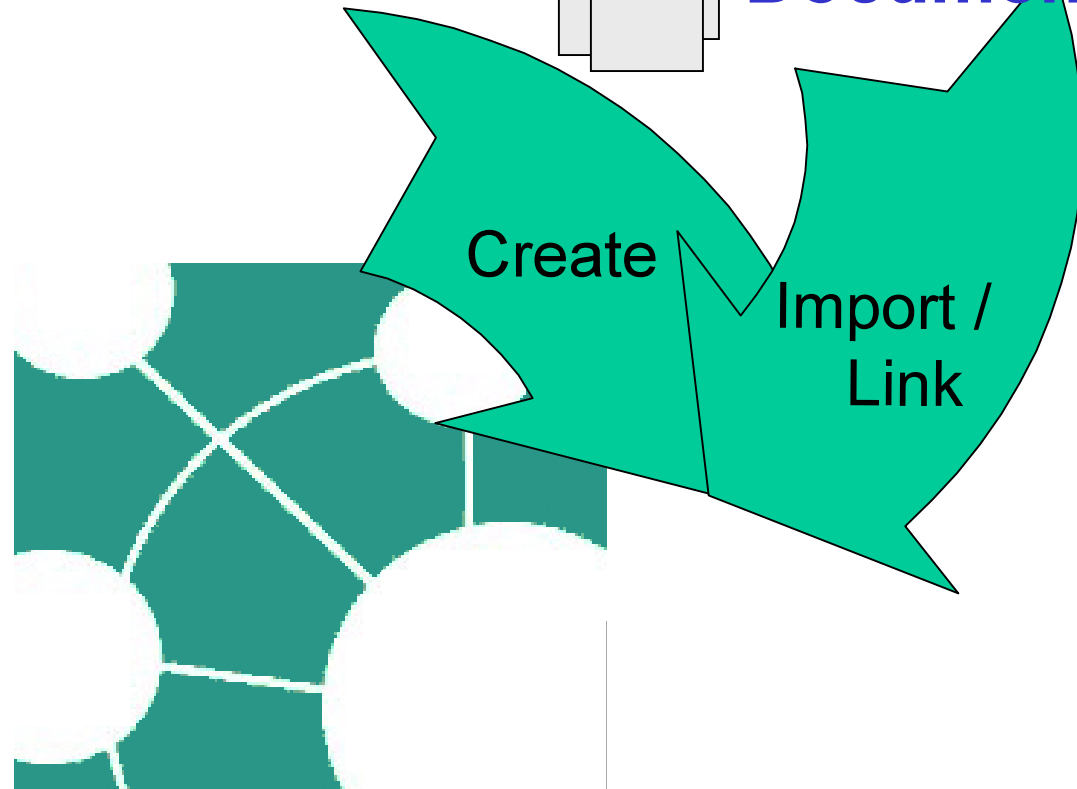
Our Ontology-based OM



**Facts
Documents**

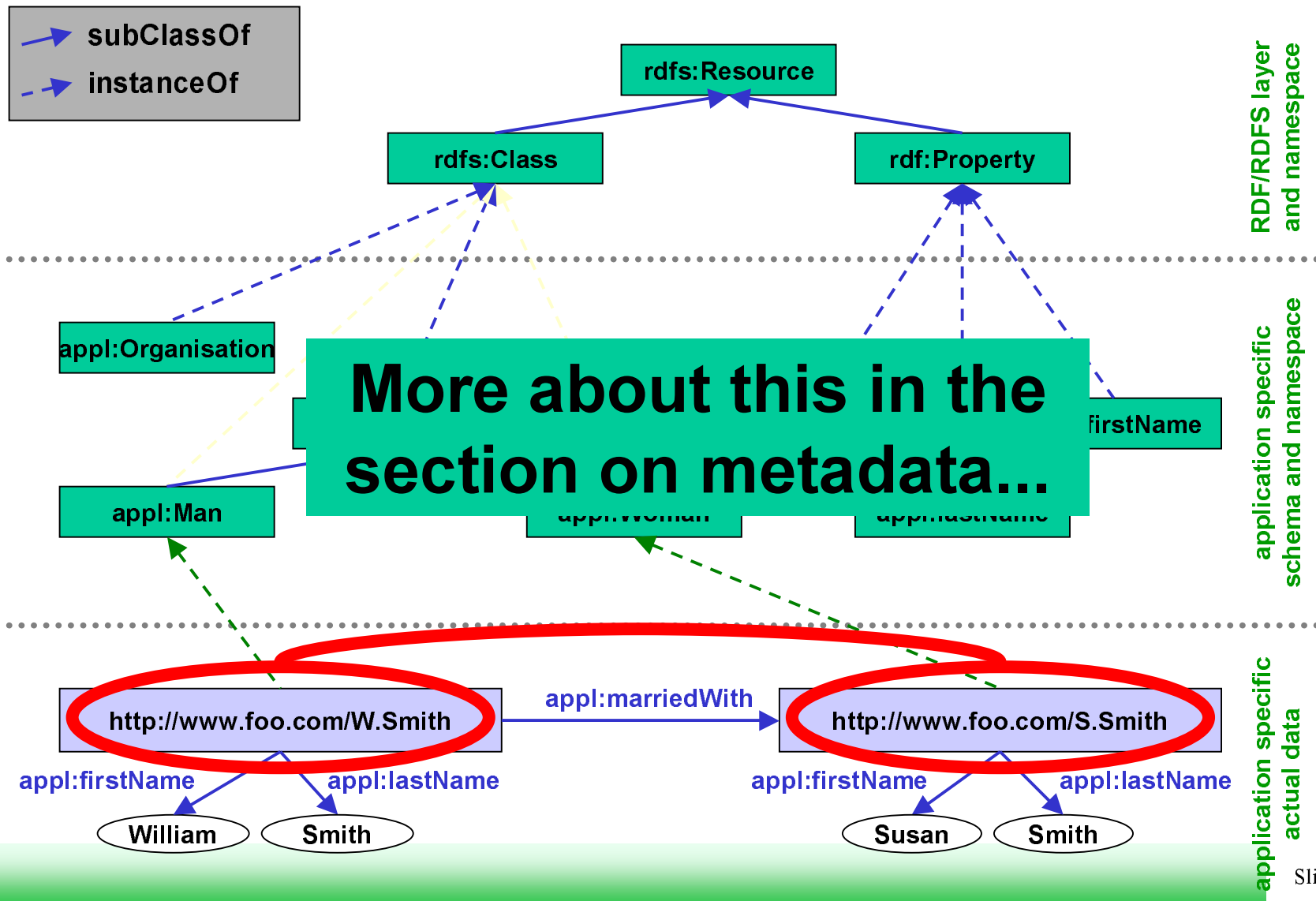


AIFB



3.4 Ontology-based Knowledge Management

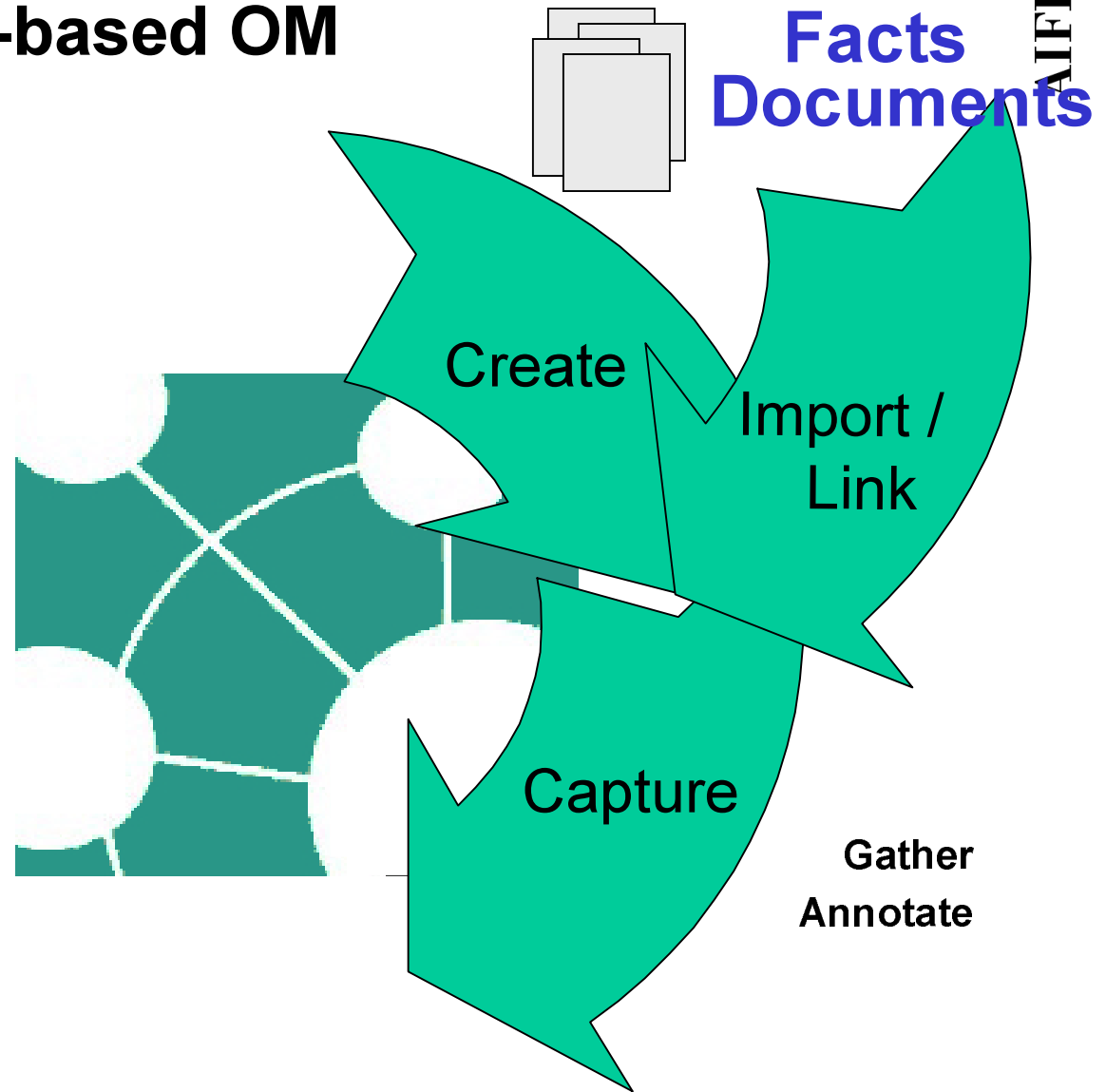
Import / Link - RDF(S)





3.4 Ontology-based Knowledge Management

Our Ontology-based OM



3.4 Ontology-based Knowledge Management

Capture - Manual Annotation

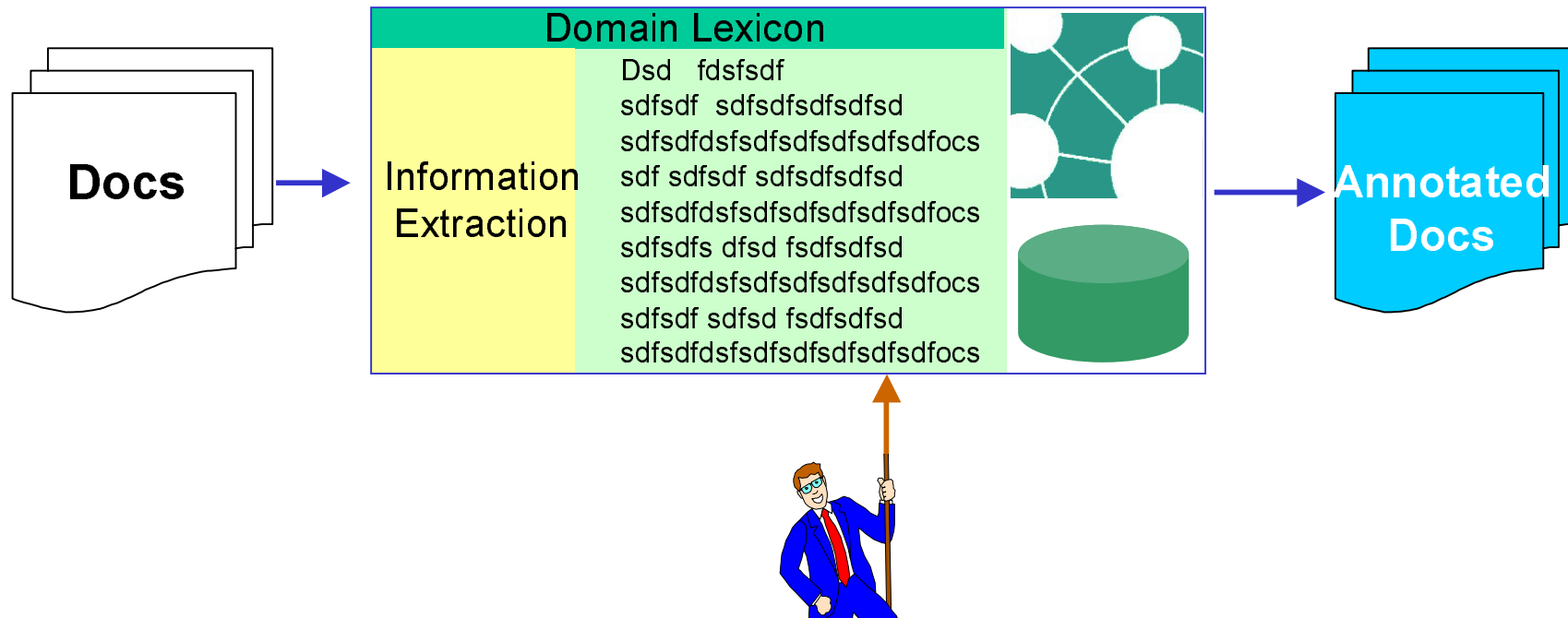
The screenshot displays the Time2Research application window. The main pane shows a web browser view of a news site with the URL <http://www.prnewswire.com/micro/MAH>. The page content includes a sidebar with links like 'quotes/dividends', 'news', 'ratios', and a main section titled 'investor information' with a 'News' subsection. A list of news items is visible, with the most recent one dated 'May 11, 2000' mentioning 'M.A. Hanna'.

On the right side, there is a 'Time2Research' annotation panel. It has tabs for 'Annotieren', 'Assistenten', and 'Suchen'. The 'Annotieren' tab is active, showing fields for 'Klasse' (set to 'Selling'), 'Objekt' (set to 'Selling1'), 'Attribut', and 'Relation' (set to 'subject'). Below these fields is a list of relations: 'hasObject', 'hasBuyer', and 'subject'. At the bottom of the panel, there is a list of entities under 'CompanyPart Neu', including 'hanna', 'mama', 'texap', 'allie', 'aveco', 'pms', and 'plast'. The 'hanna' entity is highlighted. Below the list are buttons for 'Relation löschen' and 'Relation zuweisen'. At the bottom of the panel, a text box shows the resulting annotation: 'Selling:Selling1[subject=hanna]'.

The status bar at the bottom of the application window shows the text 'M.A. Hanna', the date '5.7.2000', and the time '11:01'.

3.4 Ontology-based Knowledge Management

Capture - Semi-automatic Annotation

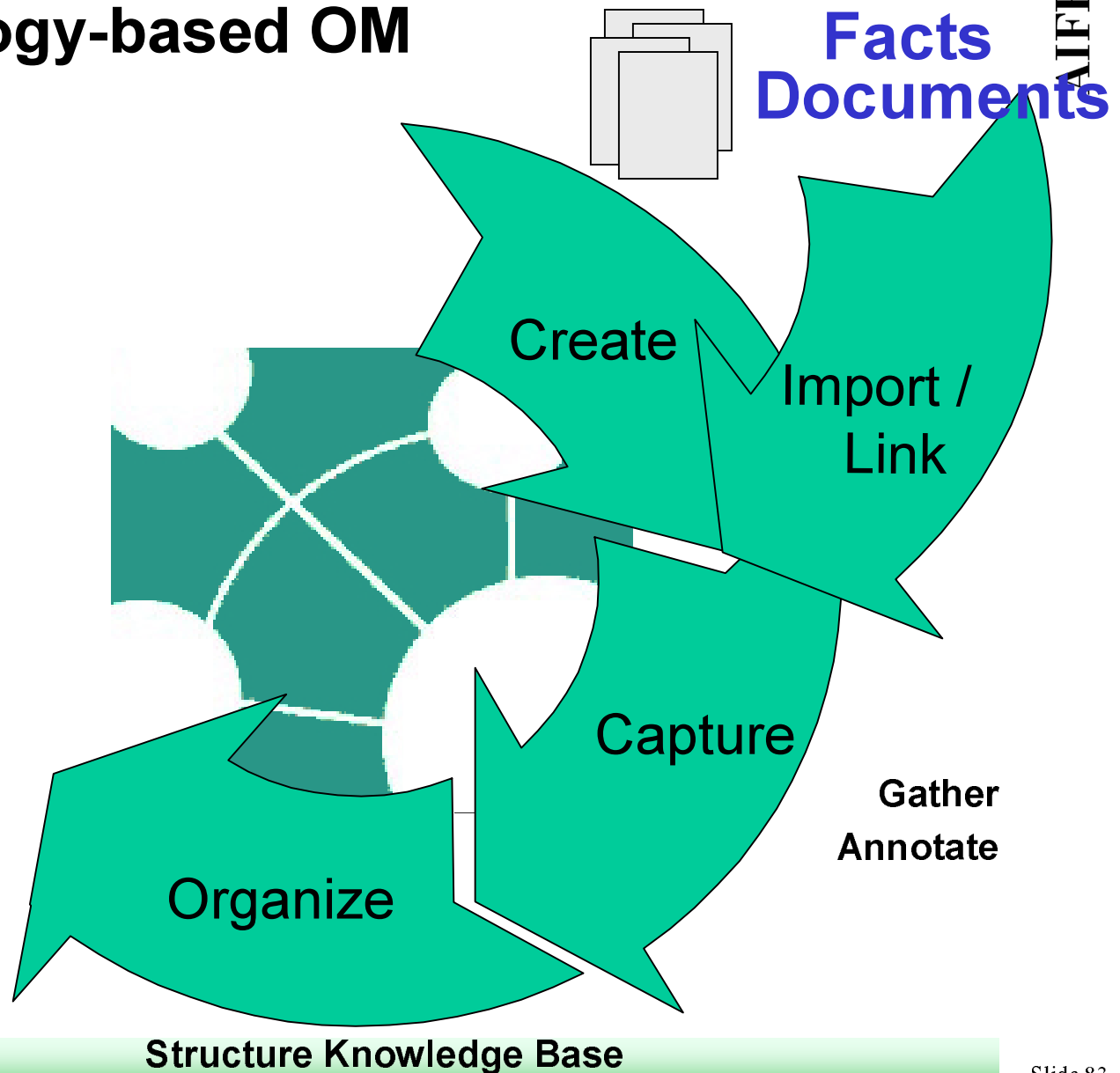


⇒ DAML
Project



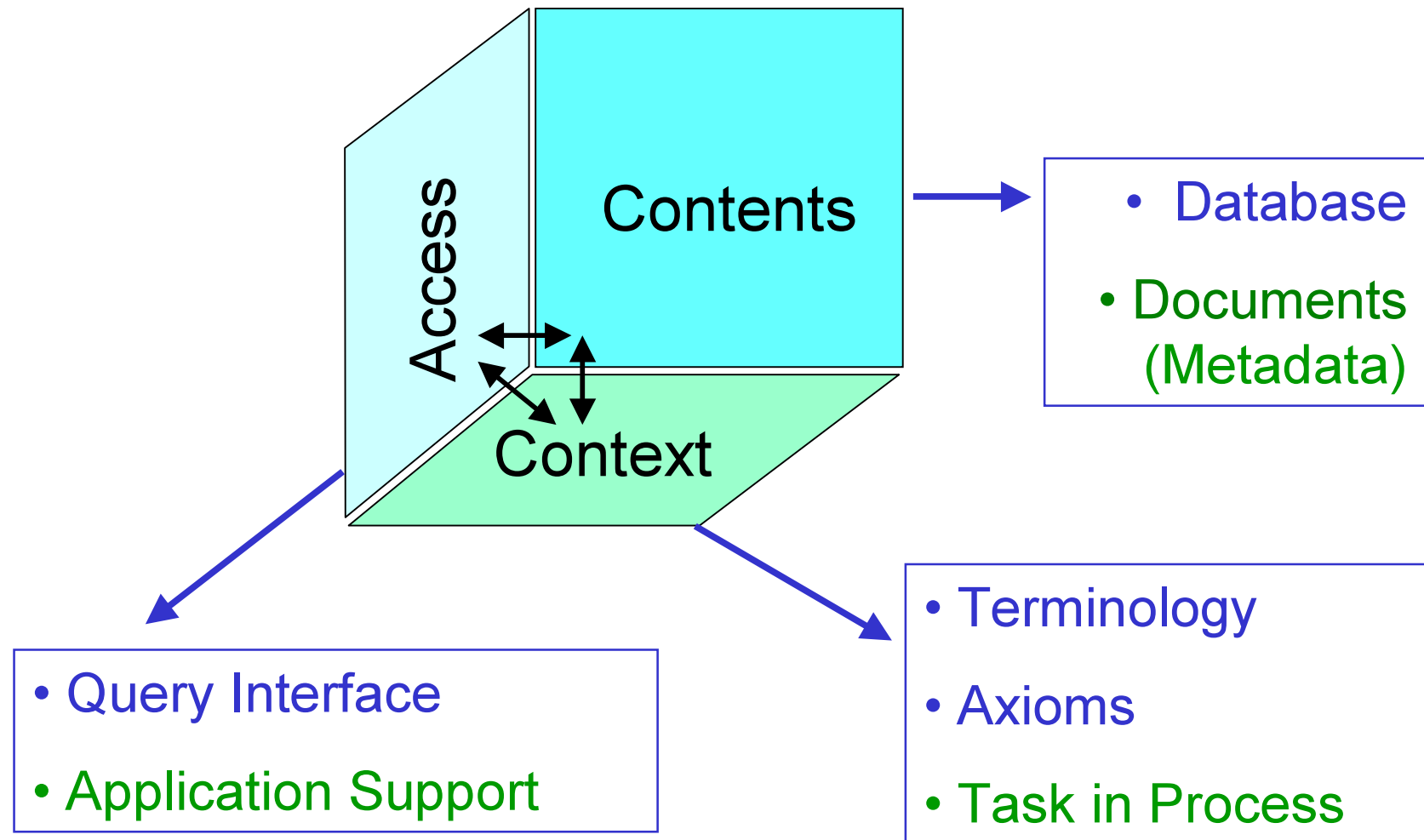
3.4 Ontology-based Knowledge Management

Our Ontology-based OM



Structure Knowledge Base

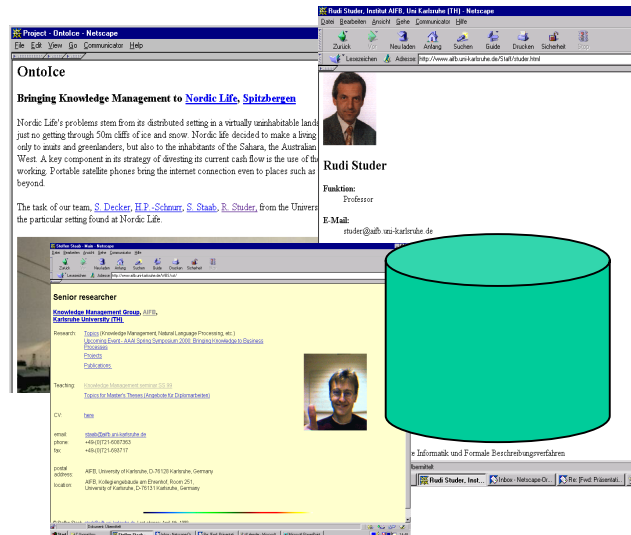
3.4 Ontology-based Knowledge Management Organize - Process Support (,...)



3.4 Ontology-based Knowledge Management

Organize - Process Support

Background Knowledge

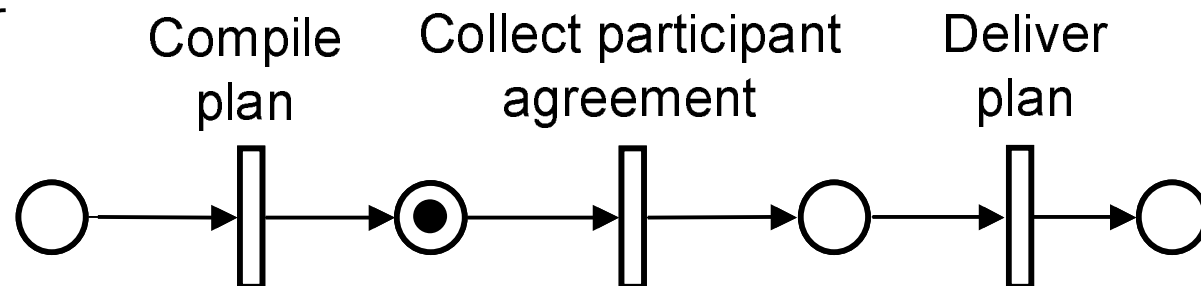


Document Template

partially filled

```
<employee>
<name>Rudi Studer</name>
<position>Professor</position>
<email>??????????</email>
....
</employee>
```

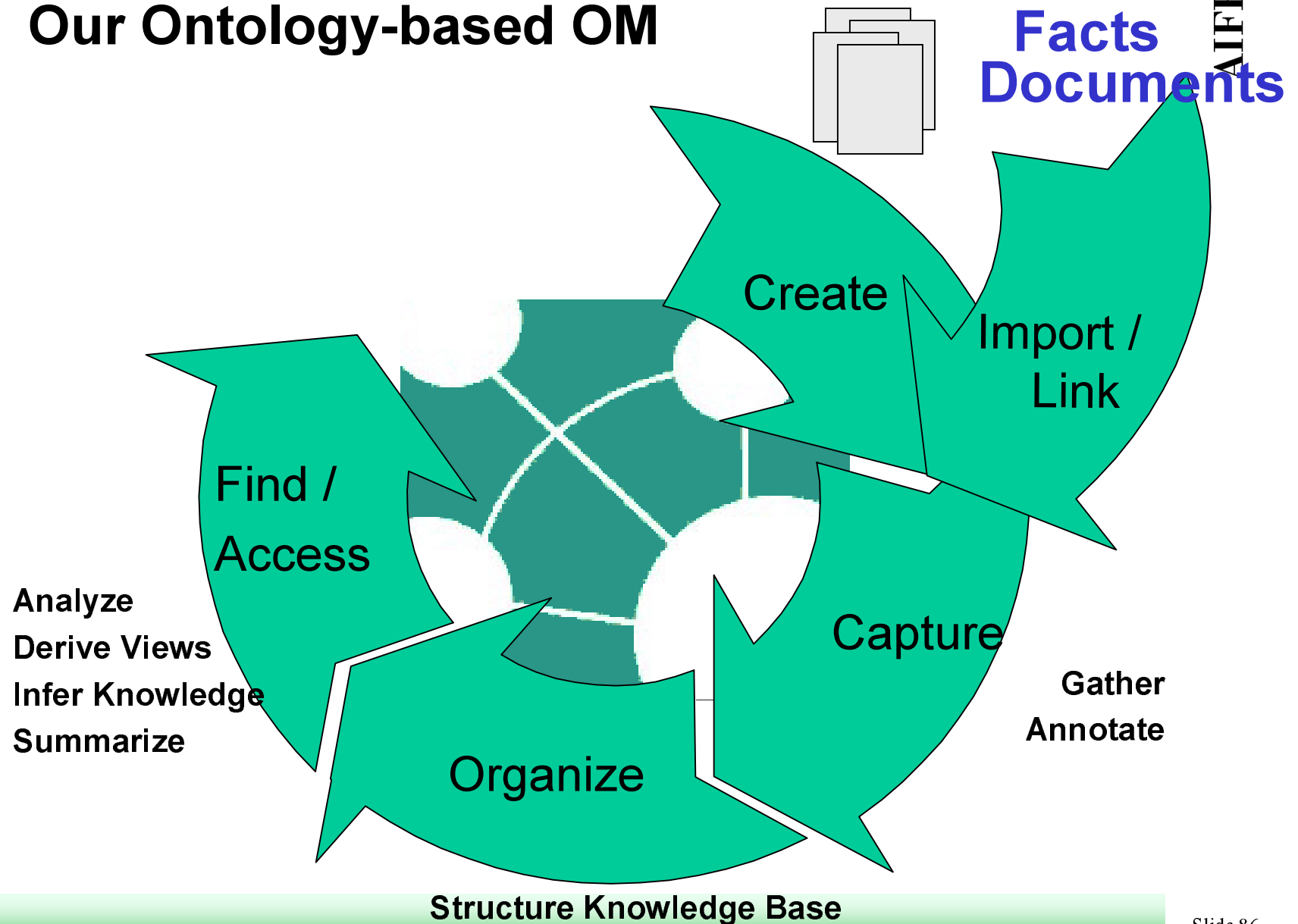
Task in Process





3.4 Ontology-based Knowledge Management

Our Ontology-based OM



3.4 Ontology-based Knowledge Management

Find - Semantic Search

The screenshot displays the Ontobroker QueryInterface, a tool for semantic search. It features two main windows:

- Object1**: A form for querying an ontology. It includes a table with columns for 'Attributes' and 'Values', and a 'Show?' checkbox. The attributes listed are:

Attributes	Values	Show?
hat_Geburstag		<input type="checkbox"/>
hat_Nationalitaet		<input type="checkbox"/>
hat_Profil		<input type="checkbox"/>
hat_Wohnort		<input type="checkbox"/>
hat_sProfil		<input type="checkbox"/>
in_Land		<input type="checkbox"/>
in_Ort		<input type="checkbox"/>
kennt_Cluster		<input type="checkbox"/>
nachname		<input checked="" type="checkbox"/>
plz		<input type="checkbox"/>
strasse		<input type="checkbox"/>
telefon		<input type="checkbox"/>
titel		<input type="checkbox"/>
url		<input type="checkbox"/>
vorname		<input checked="" type="checkbox"/>

 Below the table are buttons for 'Select All', 'Clear', and 'Query'.
- Hyperbolic View**: A visualization of the ontology structure. It shows a central 'Root' node connected to various concepts like 'Ort', 'Zeit', 'Dimensionen', 'Dokument', 'Person', 'Profil', 'Skill', 'Stelle', 'Sprache', 'Cluster', and 'Bewerbung'. These concepts are further connected to more specific nodes, such as 'Land', 'Stadt', 'Zeitpunkt', 'Zeitraum', 'Homepage', 'Projektbericht', 'Bewerber', 'Mitarbeiter', 'Persoexprofil', 'Sammelprofil', 'Stellenprofil', 'Branche', and 'Sprache'.

3.4 Ontology-based Knowledge Management

Find - Semantic Search

KA2 Portal - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: http://aifbbacchus.aifb.uni-karlsruhe.de/ka2_demo/website/ What's Related

BSCW Google DBLP Bibliograp ResearchIndex RealPlayer LEO English/Ger E-Plus Portal Währungsrechner DirectB@nking

KA² knowledge acquisition community **KBNavigate** **Search - Personalization - Feedback**

Concept: Researcher

Persons

Projects

Organization

Publications

Research Topics

Events

About the System

Home

Superconcepts:

[Concept-Overview](#) >>> [Object](#) >> [Person](#) >> [Employee](#) >> [AcademicStaff](#) >>> **Researcher**

Subconcepts:

[PhDStudent](#)

Instances:

<http://kmi.open.ac.uk/~enrico>

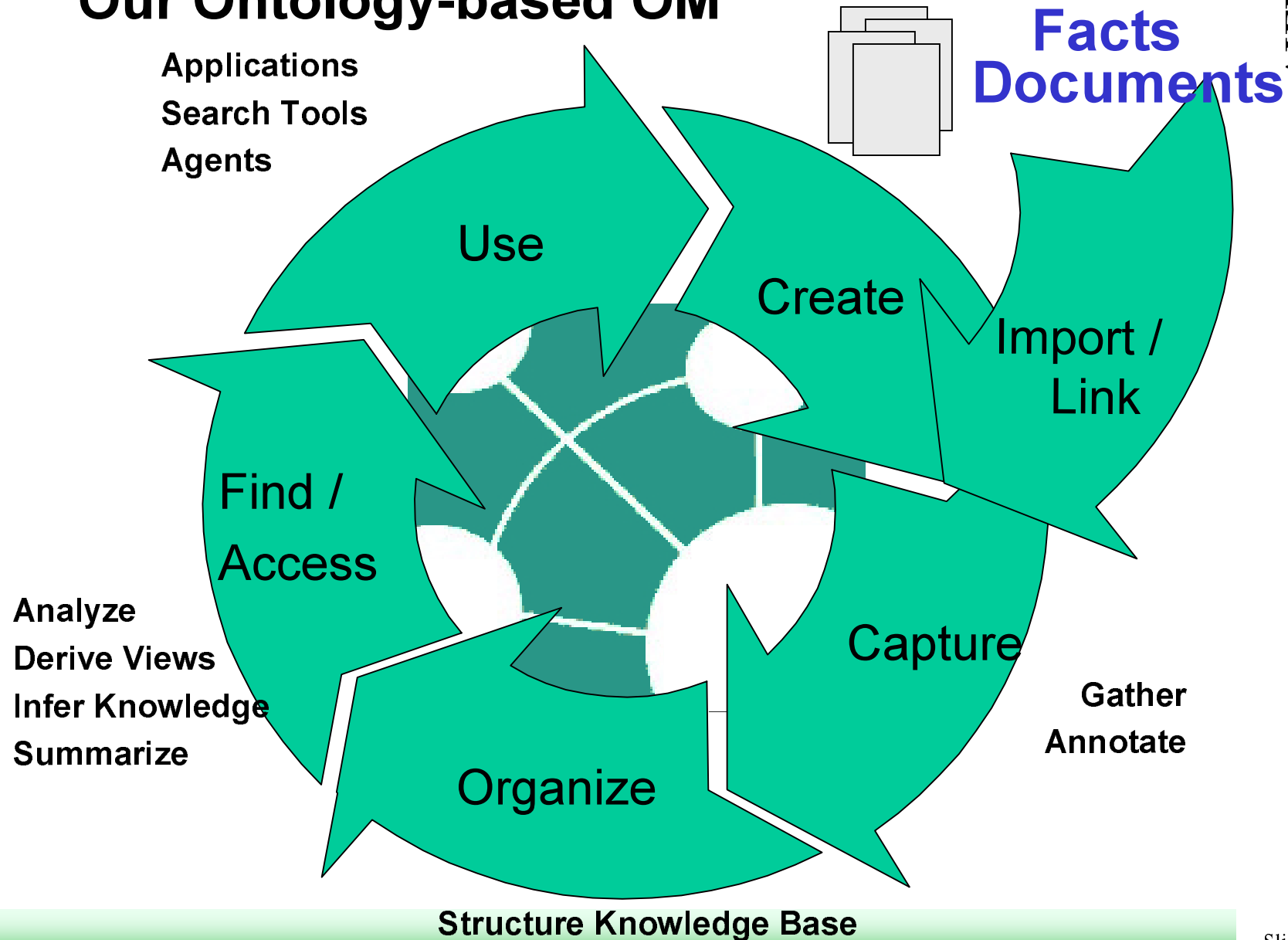
email	mailto:E.Motta@open.ac.uk	STRING
fax	+44 1908 653169	STRING
lastName	Motta	STRING
phone	+44 1908 653506	STRING
publication	http://www.aifb.uni-karlsruhe.de/~mer/Pages/enrico.html#EM4	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/~mer/Pages/enrico.html#EM5	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/~mer/Pages/enrico.html#EM2	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/~mer/Pages/enrico.html#EM3	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/WBS/publications/pub97.html#BFP+97	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/WBS/publications/pub97.html#FMD+97	Publicatio
publication	http://www.aifb.uni-karlsruhe.de/~mer/Pages/enrico.html#EM1	Publicatio

Document Done



3.4 Ontology-based Knowledge Management

Our Ontology-based OM



3.4 Ontology-based Knowledge Management

Use

Semantic Community Web Portal - KA2Portal

KA² knowledge acquisition community

KBNavigate Search - Personalization - Feedback

Welcome to the **KA² Community Web**

Within this Community Web, you will get a lot of information about Knowledge Acquisition and the people involved in that topic. The site contains information and links and is organized and maintained distributed. The **KA² Community Web** pages are generated automatically by the famous **ONTOBROKER** System which is also responsible for the Semantic Search and the Agent functionality.

At a glimpse:
[KAW99 in Banff](#)
[OntoServer-Project](#) at the [AIFB](#), University of Karlsruhe, Germany

6.October, 1999 by HPS

Internet

Gather (Information Integration)
 Structure, Distribute
 Allow for semantic search

3.4 Ontology-based Knowledge Management

Use

Management of Skill Knowledge - OntoProPer

ProPer WebDemo - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit

Address http://aifbhades.aifb.uni-karlsruhe.de/proper/website/proper_index.htm

ProPer Human Resource Ontology [Hyperbolic View - Feedback](#)

[Competence](#)
[Projects](#)
[People](#)
[Info](#)
[Home](#)

Find competence

in skill
in cluster
Facts are

submit

Results:

NAME	SKILL	VALUE	CLUSTER	TYPE
Maria Stuart	Englisch	0	Sprachen	Bewerber
Harald Toli	Englisch	0	Sprachen	Mitarbeiter

Internet

Approximate Matches
Maintenance
Decentral Contribution

3.4 Ontology-based Knowledge Management

Use

Management of Corporate Research - CHAR

Decentral Contribution
Multiple Views
Derived Views
Strategic Questions

Corporate History Analysis - Chemical Industry

Mergers & Acquisitions, Sellings and Restructurings, Management Changes and Outsourcing Activities.

Browse through Archive

Company :

Period:

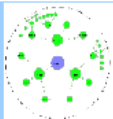
☒ all
☐ last 12 months
☐ from to

Activities:

All activities	<input checked="" type="checkbox"/>
Acquisitions	<input type="checkbox"/>
Sellings	<input type="checkbox"/>
Mergers	<input type="checkbox"/>
Restructuring	<input type="checkbox"/>
Management Changes	<input type="checkbox"/>

Strategic Questions

Search



Date: select:

Organization:

Subsidiaries	<input type="checkbox"/>
Business Areas	<input type="checkbox"/>
Divisions	<input checked="" type="checkbox"/>
Sites	<input type="checkbox"/>
Manager	<input type="checkbox"/>
KnowHow	
in Market	<input type="checkbox"/>
in Region	<input type="checkbox"/>
in Technology	<input type="checkbox"/>

Fertig Internet

3.4 Ontology-based Knowledge Management

Use

Management of Corporate Research - CHAR

Business Areas and Divisions of M.A.Hanna at 01.10.93

Division	Texapol Corporation
Division	Allied Color
Division	Avecor
Division	PMS Consolidated
Division	Plásticos Polisol
Division	Southwest Chemical
Division	Global Processing Corp.
Division	Burton Rubber
Division	Day International
Division	Bruck Plastics
Division	Gulf Colour
Division	Synthecolor
Division	Fiberchem
Division	Wilson Colorants
Division	Plastics Distribution Corp.
BusinessArea	Plastic Compounding
	Colorants
	Rubber Compounding
	Resin Distribution
	Shapes Distribution
	Engineered Materials Group
	Burton Rubber
	M.A.Hanna de Mexico
	M.A.Hanna Color
	M.A.Hanna Rubber
	M.A.Hanna Resin Distribution

Business Areas and Divisions of M.A.Hanna at 01.04.97

Division	Plásticos Polisol
Division	EnviroCare Compounds (ECC)
Division	North Coast Compounding
Division	Day International
Division	Bruck Plastics
Division	Gulf Colour
Division	Synthecolor
Division	Fiberchem
Division	Plastics Distribution Corp.
BusinessArea	Plastic Compounding
	Compounding Technology, Inc. (CTi)
	Southwest Chemical
	Bergmann GmbH
BusinessArea	Colorants
	Victor International
	Wilson Colorants
BusinessArea	Rubber Compounding
BusinessArea	Resin Distribution
BusinessArea	Shapes Distribution
Division	Engineered Materials Group
	Texapol Corporation
Division	M.A.Hanna de Mexico
Division	M.A.Hanna Color
	Allied Color
	Avecor
	PMS Consolidated

Decentral Contribution
Multiple Views
Derived Views
Strategic Questions

3.4 Ontology-based Knowledge Management

Use

Management of Configuration Knowledge - ONKO

Telekom-Konfigurationsmanager - Microsoft Internet Explorer

File Edit View Favorites Extras ? Links »

Konzepte is_a has_part **Attribute** **Konfigurationen** aktuell Archiv Detail

Hardware
Programm
 Applikation
 Entwicklungstool
 Systemsoftware
 Betriebssystem
 DBMS
 WebServer
 Alibaba
 Apache
 Domino
 Jigsaw
 MicrosoftWebServer
 NetscapeFastTrack
 Omni
 WebSTAR
 WebSite
 Xitami
 Utility
 Programmiersprache
 Technische Plattform

Attribute:
 hatAnbieter
 hatHersteller
 hatPreisProLizenz
 hatPreisProServer
 unterstuetztZugriffe

Relationen:
 laeuftAufBetriebssystem
 benutztUtility
 geschriebenIn
 unterstuetztServerSideSprache

Restriktionen:
 Betriebssystem
 WebServerUtility
 Programmiersprache
 Programmiersprache

aktuelle Konfiguration **Fehlermeldung** **kompatible Alternativen**

Linux
Omni

Microsoft Internet Explorer

Konfiguration nicht kompatibel

OK

Löscher

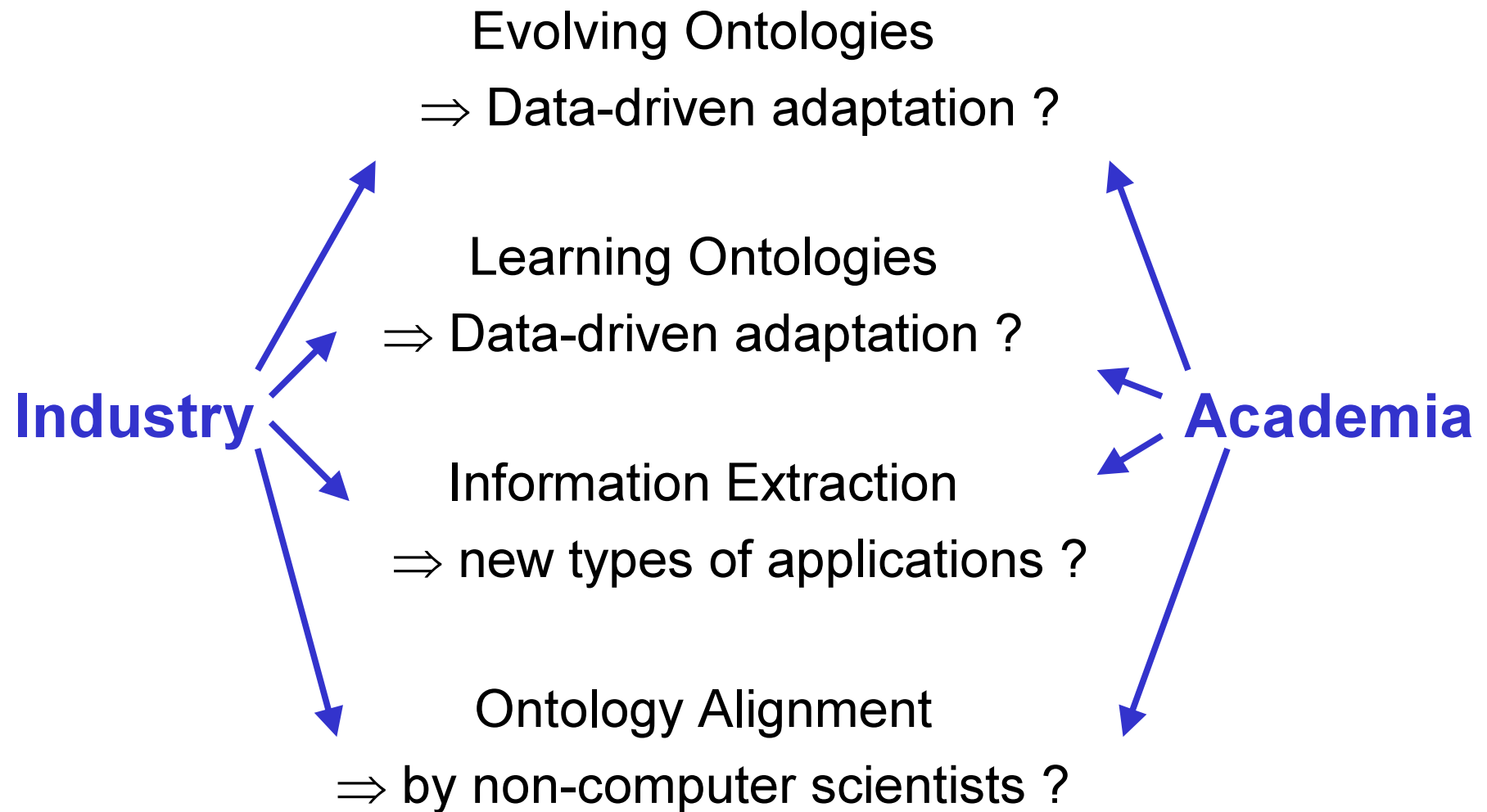
Deutsche Telekom

Experience Base Rule Base

- positive Rules
- negative Rules

3.4 Ontology-based Knowledge Management

Open Topics





3.4 Ontology-based Knowledge Management

Wrap-up for Onto-based OMs

Don't forget the overall process!

From containers to contents!



Meta-Data based Knowledge Management



Objective

Tight integration:



In Knowledge Management

3.5 Meta-Data based Knowledge Management

What is Meta-Data?

- Structured data about data
- provides basic information about resources (e.g documents in a company)
 - such as the author of a work, the date of creation, links to any related works
 - enables more effective search
- Example: meta-data is the card index catalogue in a library (meta-data about books)
- Meta-Data needs Standards
 - Which fields are available?
 - What to fill in?
 - Interoperability
 - Tool Development



3.5 Meta-Data based Knowledge Management

Meta-Data Standard: Dublin Core

- (Simple!) Ontology for Metadata: Dublin Core
- 15 element metadata set
- resource discovery
- Web-based document-like objects
- emphasis on semantics
- widespread consensus
- several syntaxes
- <http://purl.oclc.org/dc>



3.5 Meta-Data based Knowledge Management

Meta-Data Standard: Dublin Core

- Title
- Creator
- Subject
- Description
- Publisher
- Contributor
- Date
- Type
- Format
- Identifier
- Source
- Language
- Relation
- Coverage
- Rights

3.5 Meta-Data based Knowledge Management

Meta-Data Representation on the Inter-/Intranet

- Standards for Meta-Data Representation enable:
 - Interoperability
 - cost-effective development of tools
- W3C Recommendation for representing Dublin Core:
 - Resource Description FrameWork [O. Lassila, 1999]
- RDF is able to represent more than Dublin Core
 - World Wide accepted Ontology Representation Standard (?)

3.5 Meta-Data based Knowledge Management

Introduction to RDF

- RDF (Resource Description Framework)
 - Beyond Machine readable to *Machine understandable*
- RDF unites a wide variety of stakeholders:
 - Digital librarians, content-raters, privacy advocates, B2B industries, AI...
 - Significant (but less than XML) industrial momentum, lead by W3C
- RDF consists of two parts
 - RDF Model (a set of triples)
 - RDF Syntax (different XML serialization syntaxes)
- RDF Schema for definition of Vocabularies (simple Ontologies) for RDF (and in RDF)

3.5 Meta-Data based Knowledge Management

Design Goal for RDF

- 1.) Knowledge on Networks is distributed -
link Knowledge
- 2.) There is no universal truth and many opinions (Knowledge on
the Web is biased)
it must be possible to dispute statements
- 3.) Many different user communities (one can't know what they
want to represent)
Extensibility and Simplicity



3.5 Meta-Data based Knowledge Management

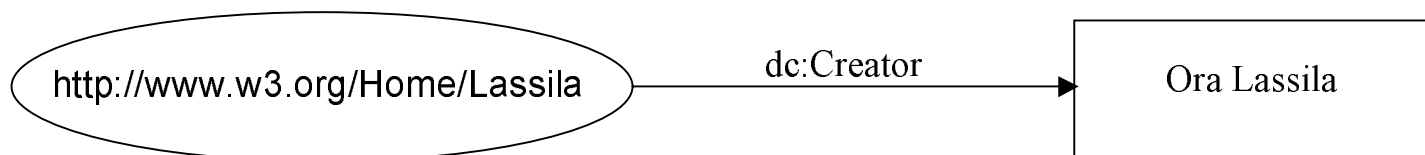
RDF Data Model

- **Resources**
 - A resource is a thing you talk about (can reference)
 - Resources have URI's
 - RDF definitions are itself Resources (linkage)
- **Properties**
 - slots, define relationship to other resources or atomic values
- **Statements**
 - “Resource has Property with Value”
 - (Values can be resources or atomic XML data)
- **Similar to Frame Systems**

3.5 Meta-Data based Knowledge Management

A Simple Example

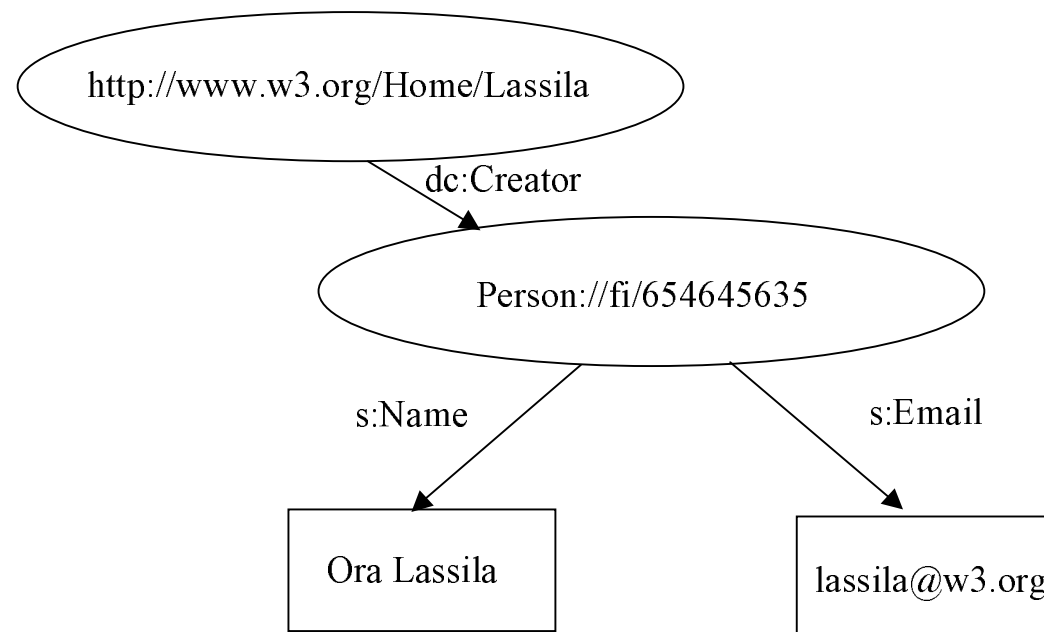
- **Statement**
 - “Ora Lassila is the creator of the resource
<http://www.w3.org/Home/Lassila>”
- **Structure**
 - Resource (subject) <http://www.w3.org/Home/Lassila>
 - Property (predicate) <http://purl.org/dc/elements/1.1/creator>
 - Value (object) “Ora Lassila”
- **Directed graph**



3.5 Meta-Data based Knowledge Management

Another Example

- To add properties to Creator, point through an intermediate Resource.



3.5 Meta-Data based Knowledge Management

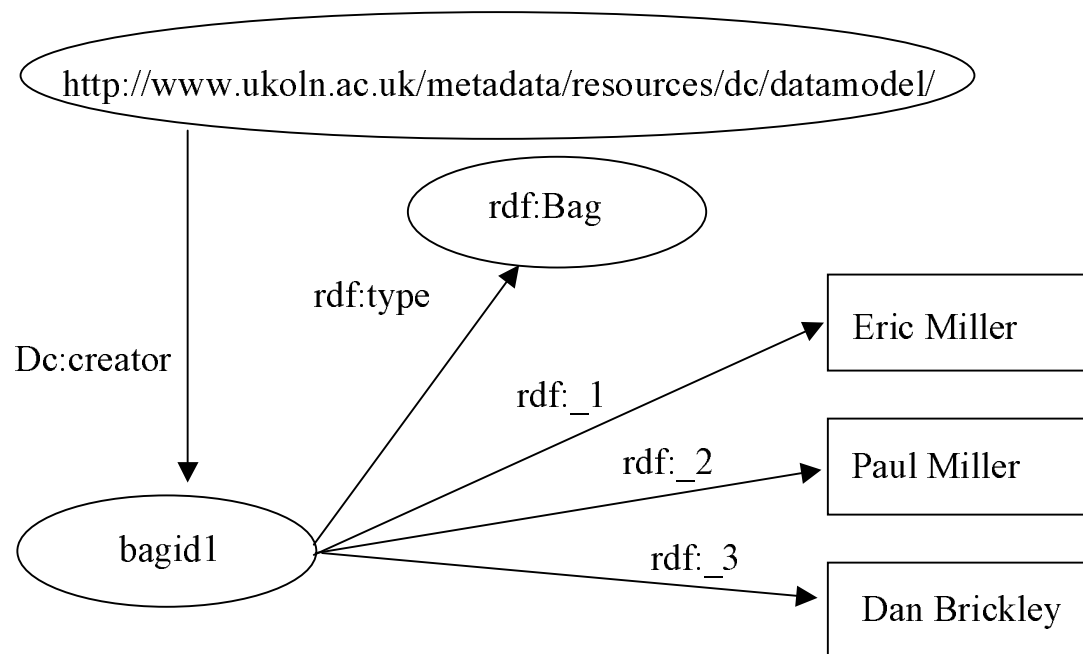
Collection Containers

- Multiple occurrences of the same PropertyType don't establish a relation between the values
 - Employee Miller knows Java, Perl and Python
 - This talk requires knowledge in Java or Python
 - (Molina, Widom, Ullman) are working at the project X
- RDF defines three special Resources:
 - **Bag** unordered values rdf:Bag
 - **Sequence** ordered values rdf:Seq
 - **Alternative** single value rdf:Alt
 - Core RDF does not enforce 'set' semantics amongst values

3.5 Meta-Data based Knowledge Management

Example: Bag

- *The creators of the document*
<http://www.ukoln.ac.uk/metadata/resources/dc/datamodel> are
Eric Miller, Paul Miller, and Dan Brickley.





3.5 Meta-Data based Knowledge Management

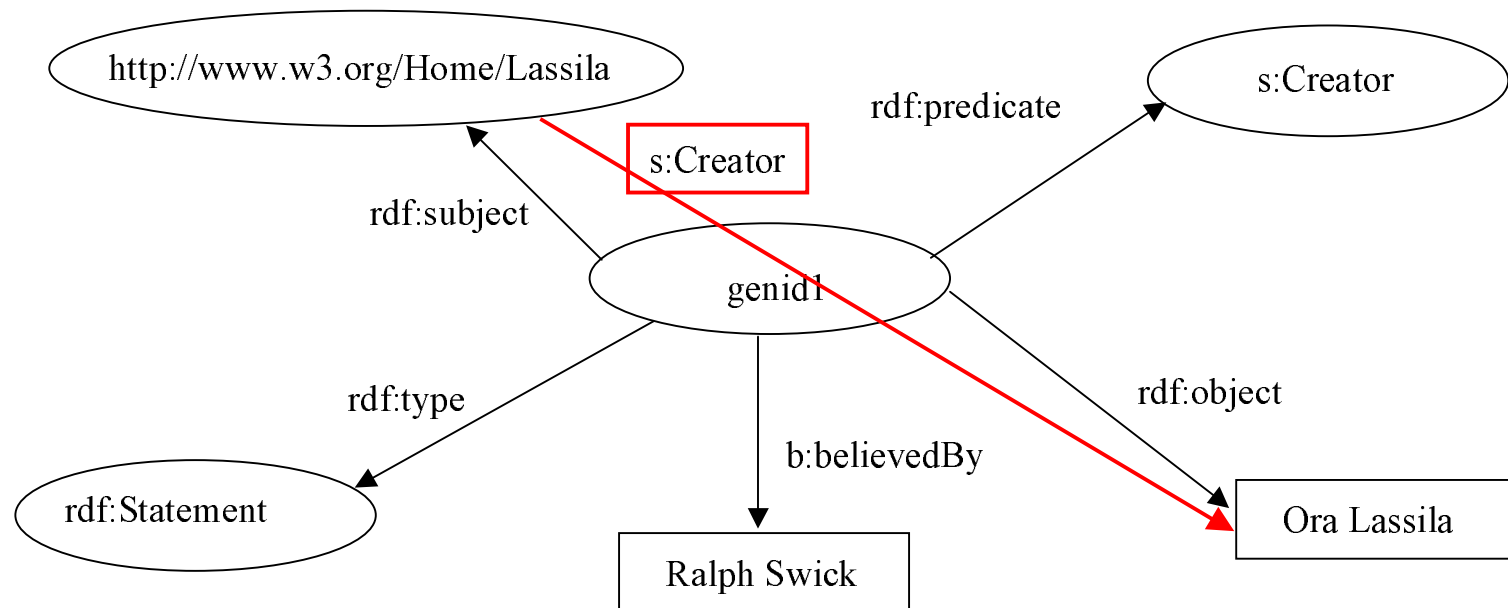
Statements about Statements

- Making statements about *statements* requires a process for transforming statements into Resources
 - **subject** the original referent
 - **predicate** the original property type
 - **object** the original value
 - **type** rdf:Statement

3.5 Meta-Data based Knowledge Management

Example: Reification

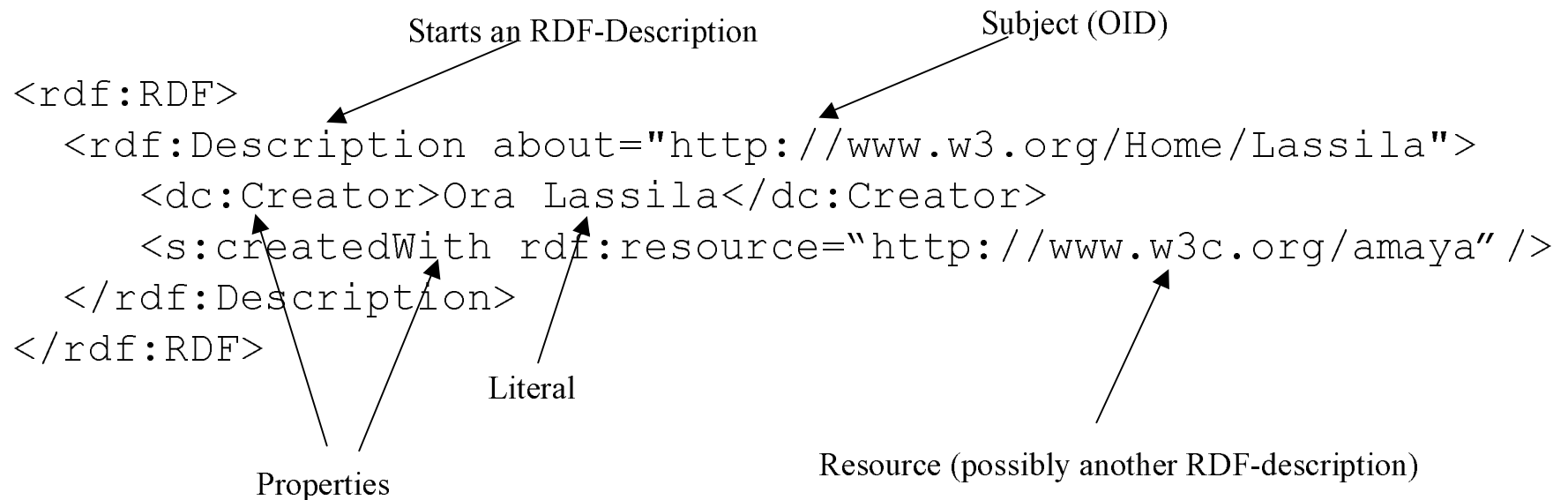
- *Ralph Swick believes that*
 - *the creator of the resource <http://www.w3.org/Home/Lassila> is Ora Lassila*



3.5 Meta-Data based Knowledge Management

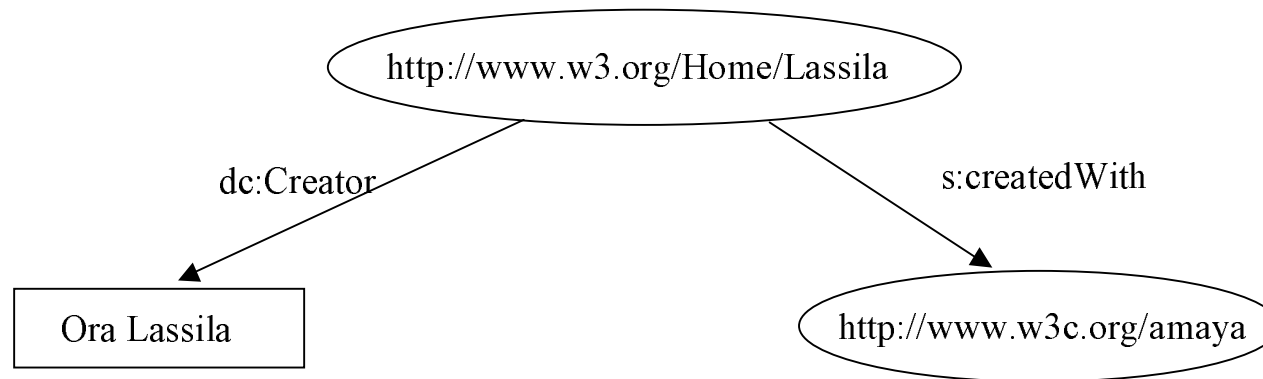
RDF Syntax I

- Datamodel does not enforce particular syntax
- Specification suggests many different syntaxes based on XML
- General form (Namespace-definitions are omitted):



3.5 Meta-Data based Knowledge Management

Resulting Graph



```
<rdf:RDF>
  <rdf:Description about="http://www.w3.org/Home/Lassila">
    <dc:Creator>Ora Lassila</dc:Creator>
    <s:createdWith rdf:resource="http://www.w3c.org/amaya" />
  </rdf:Description>
</rdf:RDF>
```

3.5 Meta-Data based Knowledge Management

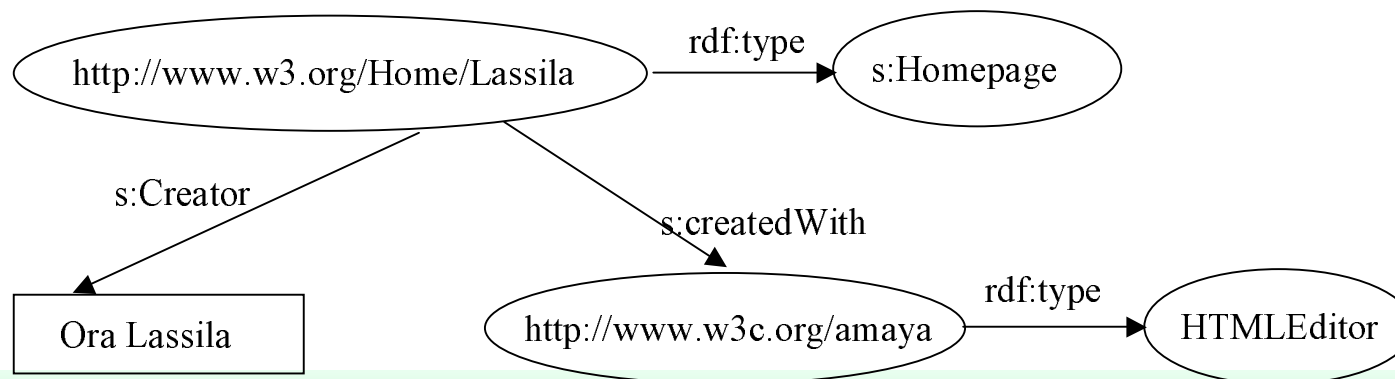
RDF Syntax II: Syntactic Varieties

Typing Information Subject (OID) In-Element Property

```

<s:Homepage rdf:about="http://www.w3.org/Home/Lassila"
              dc:Creator="Ora Lassila" />
  <dc:Title>Ora's Home Page</dc:Title>
  <s:createdWith>
    <s:HTMLEditor rdf:about="http://www.w3c.org/amaya" />
  </s:createdWith>
</s:Homepage>
  
```

Property



3.5 Meta-Data based Knowledge Management

RDF Schema (RDFS)

- RDF just defines the datamodel
- Need for definition of vocabularies for the datamodel - an Ontology Language!
- RDF schemas are Web resources (and have URIs) and can be described using RDF

[D. Brickley, 2000]

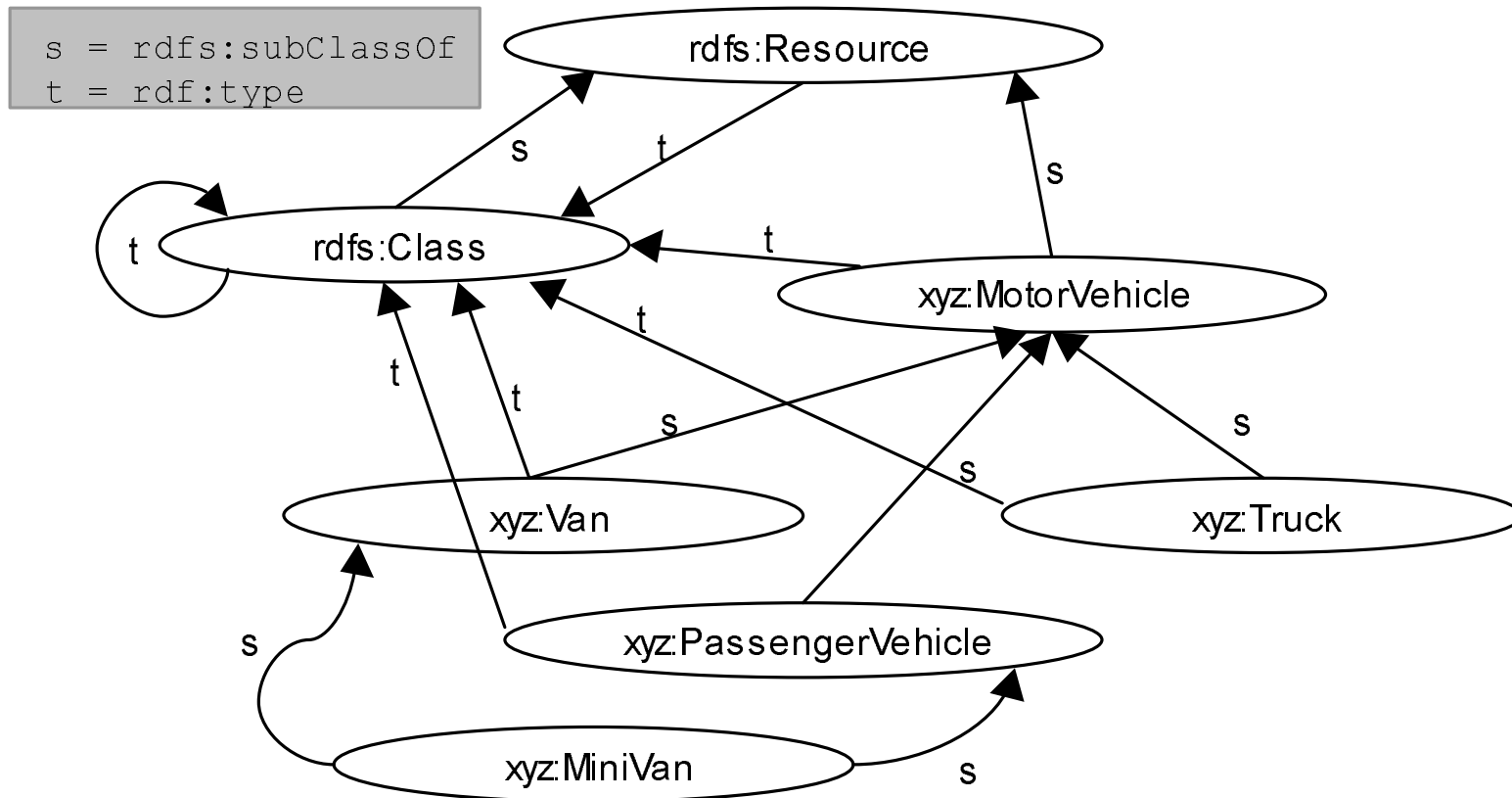
3.5 Meta-Data based Knowledge Management

Most Important Modeling Primitives

- Core Classes
 - Root-Class `rdfs:Resource`
 - MetaClass `rdfs:Class`
 - Literals `rdfs:Literal`
- `rdfs:subClassOf`-property
- Inherited from RDF: properties (slots)
- `rdfs:domain` & `rdfs:range`
- `rdfs:label`, `rdfs:comment`, etc.
- Inherited from RDF: `InstanceOf` (`rdf:type`)

3.5 Meta-Data based Knowledge Management

RDF-Schema: Example





3.5 Meta-Data based Knowledge Management

Dublin Core in RDF-Schema

```
<? xml version='1.0'?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/TR/REC-rdf-syntax#"
  xmlns:rdfs="http://www.w3.org/TR/WD-rdf-schema#"
  xmlns:dc="">

  <rdf:Description ID="Creator">
    <rdf:type rdf:resource="http://www.w3.org/TR/REC-rdf-syntax#Property"/>
    <rdfs:label>Author/Creator</rdfs:label>
    <rdfs:comment>The person or organization primarily responsible for
    creating the intellectual content of the resource. For example,
    authors in the case of written documents, artists, photographers, or
    illustrators in the case of visual resources.</rdfs:comment>
  </rdf:Description>
  . . . . .
</rdf:RDF>
```

3.5 Meta-Data based Knowledge Management

Meta-Data & RDF-Conclusions

- The larger the document corpus the more important are meta-data
- RDF is a very general (purpose) representation format
- Basis for the “Semantic Web” (eg. for automated Information Agents)
- The first widely deployed Knowledge Representation Language (?)



3.6 Topic Navigation Maps

Topic Navigation Maps

- Aiming at User Support for classifying and navigating large corpora of resources
- Topic Navigation Maps generalize:
 - indexes
 - glossaries
 - thesauri
 - catalogs
 - cross-references
- Allow browsing as well as querying for Information
- ISO Standard (ISO13250) (defined by the SGML/XML Community)

3.6 Topic Navigation Maps

Topic Navigation Maps in a Nutshell I

- Topics (e.g. Germany)
 - have a topic-type (e.g. Country)
 - at least one base-name (Germany)
 - a multiple display names (e.g. Federal Republic of Germany)
 - have occurrences (in external resources)
 - (eg. In CIA-World Fact Book: <http://www.odci.gov/cia/publications/factbook/gm.html>)
 - occurrences have a role: eg. “MENTION” (again a Topic)



3.6 Topic Navigation Maps

Topic Navigation Maps in a Nutshell II

- Topics can be related to each other via associations (eg. “Rau is_head_of Germany”)
- Association-Types (eg. “is_head_of”) are again topics.
- Association-Roles define the role of a topic in an association (“President” for “Rau”, and “Country” for “Germany”). Association-Roles are again topics.
- Any assignment of a characteristic to a topic has a scope (eg. “Rau is_head_of Germany” has scope “1999-now”)
- Axioms (eg. Transitivity or Symmetry) are considered useful, but not part of the ISO-Standard

3.6 Topic Navigation Maps

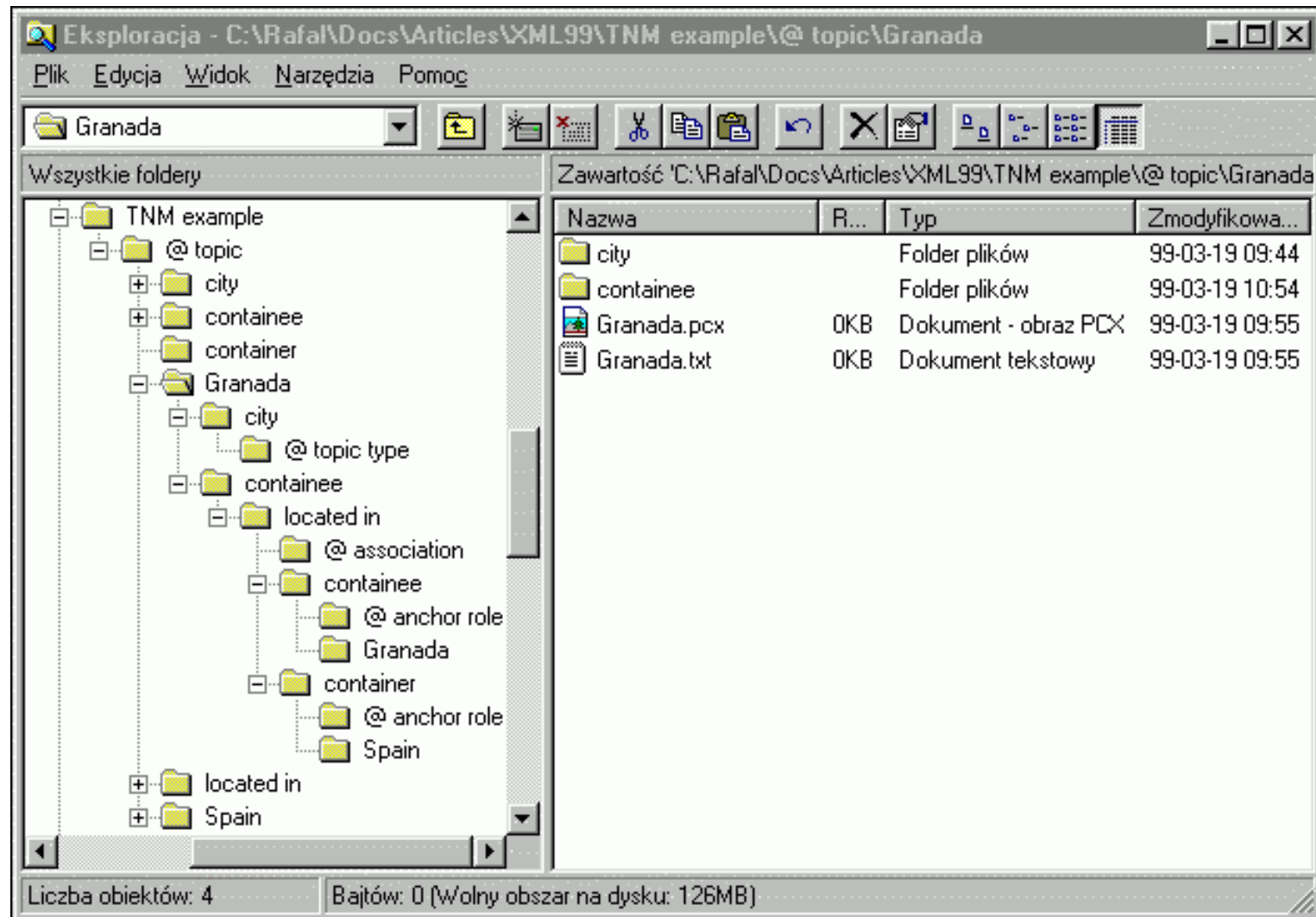
Representation

- ISO13250 defines a XML-Meta-DTD
- simplified version:

```
<topicmap>
<topic id="t1" types="COUNTRY">
  <topname>
    <basename>Germany</basename>
    <dispname>Federal Republic of Germany</dispname>
    <sortname>GERMANY</sortname>
  </topname>
  <occurs>
    <locator role="MENTION"
      href="http://www.odci.gov/cia/publications/factbook/gm.html" />
  </occurs>
</topic>
....
<assoc types="IS_HEAD">
  <assocrl role="PRESIDENT" href="#t123" />
  <assocrl role="COUNTRY" href="#t1" />
</assoc>
</topicmap>
```

3.6 Topic Navigation Maps

Example of an Browsing Interface



3.6 Topic Navigation Maps

Demonstration: The Comedy of Errors

The screenshot shows a Netscape browser window titled "STEP UK TopicMap Navigation Demonstration - Netscape". The address bar shows the URL "http://www.stepuk.star.co.uk:82/". The browser interface includes a menu bar (File, Edit, View, Go, Communicator, Help) and a toolbar with icons for Back, Forward, Reload, Home, Search, Netscape, Print, Security, Shop, and Stop. Below the toolbar is a bookmarks bar with links for Contact, People, Yellow Pages, Download, Find Sites, and Channels. The main content area is divided into two panes. The left pane, titled "List of Topics", contains a hierarchical list of links: First Merchant, Act 3, LUCIANA, DROMIO OF SYRACUSE, position-in-society, ANTIPHOLUS OF SYRACUSE, mother, LUCE, BALTHAZAR, attendant-on-the-two-Antipholuses, child, play text, Officer, PINCH, text, Act 2, AEMILIA, Act 1, play contains act, A Gaoler, ANGELO, AEGEON, Act contains scene, officer, SOLINUS, DROMIO OF EPHEBUS, twin-brothers, ANTIPHOLUS OF EPHEBUS, brothers, Second Merchant, a merchant of Syracuse, merchant, Friend, SCENE IV. A street, duke, siblings, and Friends. The right pane, titled "The Comedy of Errors", contains the following text: **Front Matter**, ASCII text placed in the public domain by Moby Lexical Tools, 1992. SGML markup by Jon Bosak, 1992-1994. XML version by Jon Bosak, 1996-1999. The XML markup in this version is Copyright © 1999 Jon Bosak. This work may freely be distributed on condition that it not be modified or altered in any way. **Dramatis Personae**, Character: SOLINUS, Duke of Ephesus. Character: AEGEON, a merchant of Syracuse. Character: ANTIPHOLUS OF EPHEBUS. Character: ANTIPHOLUS OF SYRACUSE (twin brothers, and sons to Aegeon and Aemilia.) Character: DROMIO OF EPHEBUS. Character: DROMIO OF

<http://www.stepuk.star.co.uk:82/>

3.6 Topic Navigation Maps

The Comedy of Errors: Select Topic

STEP UK TopicMap Navigation Demonstration - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: <http://www.stepuk.star.co.uk:82/> What's Related

Contact People Yellow Pages Download Find Sites Channels

Topic: ANTIPHOLUS OF EPHEBUS [\(Full Topic List\)](#)

Topic Types: [person](#)

All Associated Topics:

Select a Topic >>>

Information References:

Select a resource >>>

TopicMap Associations: involving: ANTIPHOLUS OF EPHEBUS

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person
DROMIO OF EPHEBUS	person
LUCE	person
ANGELO	person
SCENE I Before the house of ANTIPHOLUS of Ephesus.	scene
BALTHAZAR	person

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person
Officer	person
SCENE IV. A street.	scene
A Courtezan	person

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person
Officer	person
SCENE IV. A street.	scene
A Courtezan	person

The Comedy of Errors

Front Matter

ASCII text placed in the public domain by Moby Lexical Tools, 1992.

SGML markup by Jon Bosak, 1992-1994.

XML version by Jon Bosak, 1996-1999.

The XML markup in this version is Copyright © 1999 Jon Bosak. This work may freely be distributed on condition that it not be modified or altered in any way.

Dramatis Personae

Character: SOLINUS, Duke of Ephesus.

Character: AEGEON, a merchant of Syracuse.

Character: ANTIPHOLUS OF EPHEBUS

Character: ANTIPHOLUS OF SYRACUSE

(twin brothers, and sons to Aegeon and Aemilia.)

Character: DROMIO OF EPHEBUS

Character: DROMIO OF

<http://www.stepuk.star.co.uk:82/>

3.6 Topic Navigation Maps

Browse to External Reference

STEP UK TopicMap Navigation Demonstration - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: <http://www.stepuk.star.co.uk:82/> What's Related

Contact People Yellow Pages Download Find Sites Channels

Topic: ANTIPHOLUS OF EPHEBUS [\(Full Topic List\)](#)

Topic Types: [person](#)

All Associated Topics:

Select a Topic >>>

Information References:

8: speaks

TopicMap Associations: involving: ANTIPHOLUS OF EPHEBUS

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person
DROMIO OF EPHEBUS	person
LUCE	person
ANGELO	person
SCENE I Before the house of ANTIPHOLUS of Ephesus.	scene
BALTHAZAR	person

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person
Officer	person
SCENE IV. A street.	scene
A Courtezan	person

Association: Character Appears in Scene

Member of association	Role within association
ANTIPHOLUS OF EPHEBUS	person

ANTIPHOLUS OF EPHEBUS

This day, great duke, she shut the doors upon me,

While she with harlots feasted in my house.

DUKE SOLINUS

A grievous fault! Say, woman, didst thou so?

ADRIANA

No, my good lord: myself, he and my sister

To-day did dine together. So befall my soul

As this is false he burdens me withall

LUCIANA

Ne'er may I look on day, nor sleep on night,

But she tells to your highness simple truth!

ANGELO

O perjured woman! They are both forsworn:

In this the madman justly chargeth them.

ANTIPHOLUS OF EPHEBUS

My liege, I am advised what I say,

Neither disturbed with the

<http://www.stepuk.star.co.uk:82/>

3.6 Topic Navigation Maps

Browse to other Persons

STEP UK TopicMap Navigation Demonstration - Netscape

File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: <http://www.stepuk.star.co.uk:82/> What's Related

Contact People Yellow Pages Download Find Sites Channels

Topic: person [\(Full Topic List\)](#)

Topic Types:

Other Topics Of Type: person

- [ANTIPHOLUS OF EPHEBUS](#)
- [Second Merchant](#)
- [ANGELO](#)
- [BALTHAZAR](#)
- [SOLINUS](#)
- [ADRIANA](#)
- [Officer](#)
- [First Merchant](#)
- [LUCIANA](#)
- [DROMIO OF EPHEBUS](#)
- [ANTIPHOLUS OF SYRACUSE](#)
- [DROMIO OF SYRACUSE](#)
- [PINCH](#)
- [A Gaoler](#)
- [AEGEON](#)
- [LUCE](#)
- [A Courtezan](#)
- [AEMILIA](#)

ANTIPHOLUS OF EPHEBUS

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woman, didst thou so?

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In this the madman justly
chargeth them.

ANTIPHOLUS OF EPHEBUS

My liege, I am advised
what I say,

<http://www.stepuk.star.co.uk:82/>

3.6 Topic Navigation Maps

Conclusion

- Topic Navigation Maps define a simple Ontology Language (created by a non-AI community)
- Aiming at User Interaction (Browsing/Querying)
- Similar to RDF
- Need for Extensions (eg. axioms, background knowledge)

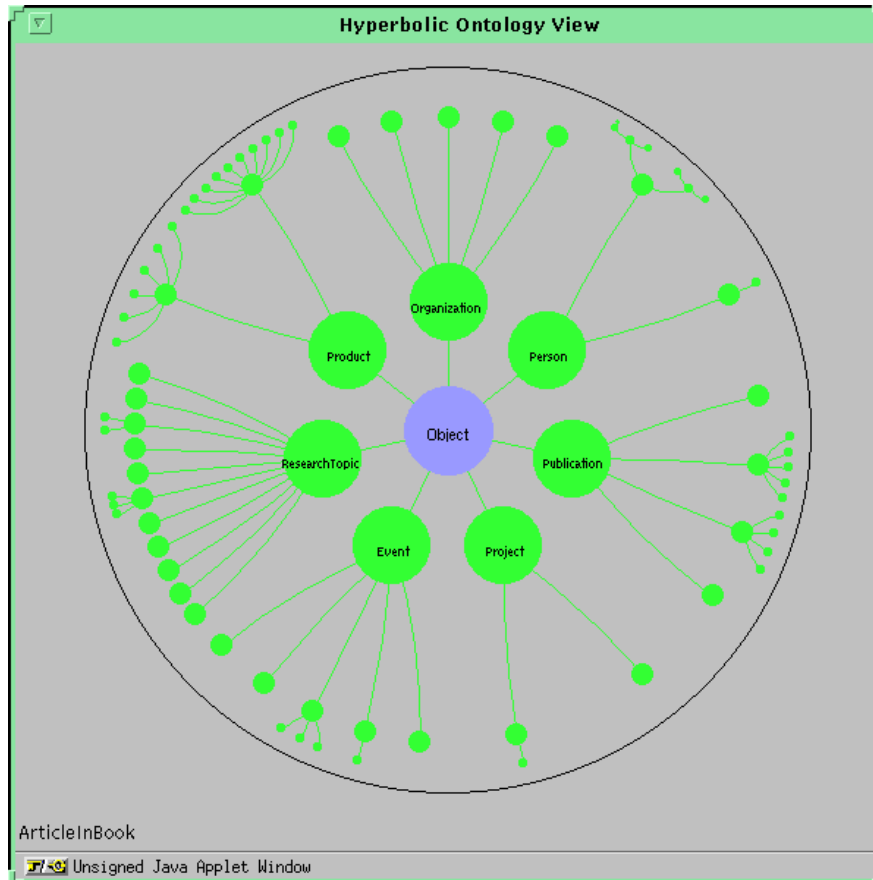
3.7 Visualization in Knowledge Management

Visualization in Knowledge Management

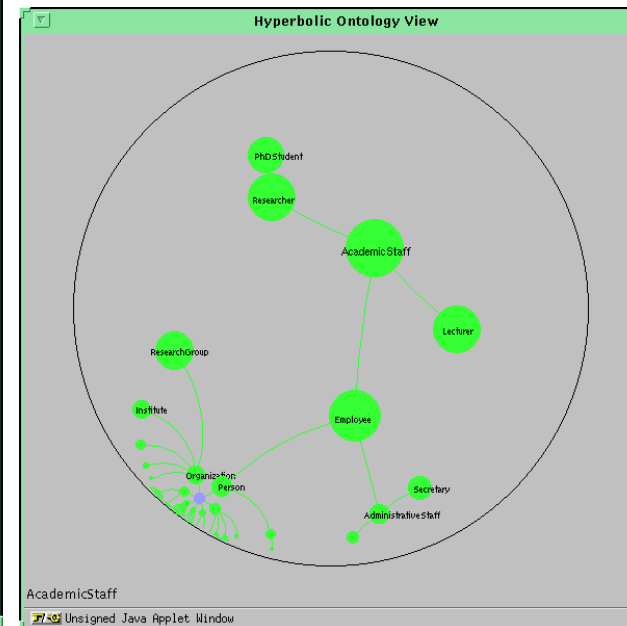
- Knowledge Management involves browsing large complex data sets (eg. Ontologies)
- Common Visualization Techniques are not sufficient
- “lost in the Ontology” syndrom

3.7 Visualization in Knowledge Management

Visualizing Hierarchies: 2D Hyperbolic Viewer



- “Focus & Context”
- Smooth Navigation



[J. Lamping 1996]

Visualizing Hierarchies: 3D Hyperbolic View

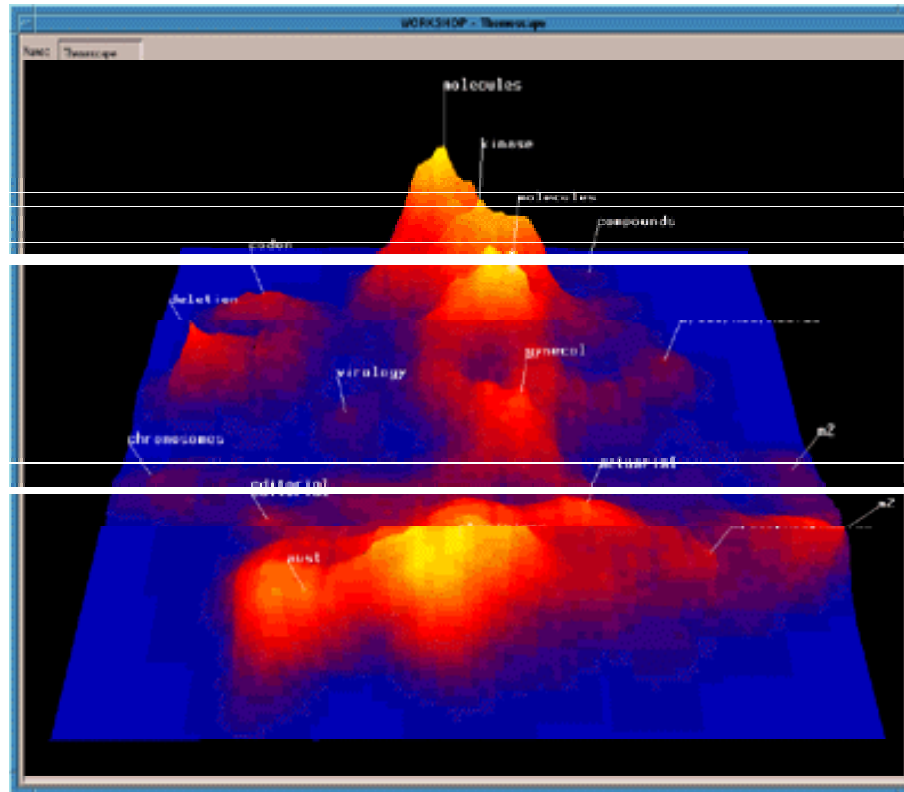


[T. Munzner 1998]

3.7 Visualization in Knowledge Management

Document Visualization

- Visual Support for Navigation and Browsing in a Set of Document
- Topic distribution in a large document space:



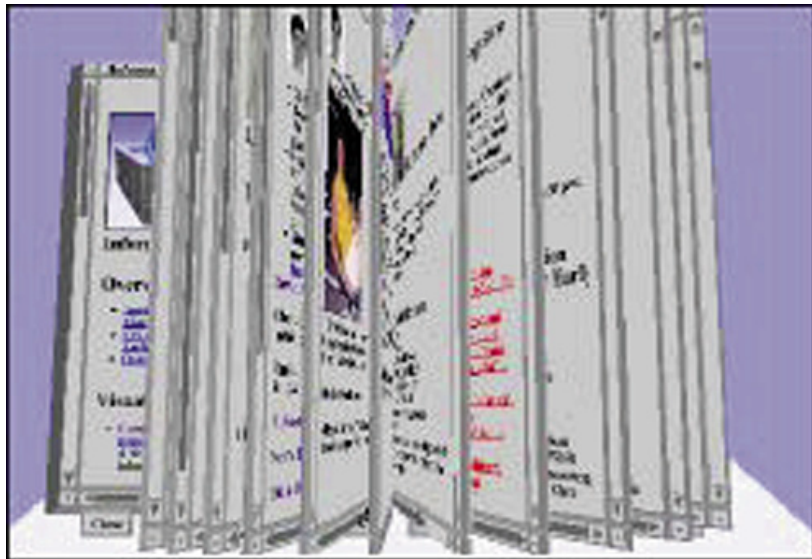
- content abstraction and spatialization of the document

[J.A. Wise 1995]

3.7 Visualization in Knowledge Management

Document Visualization

- Visual Support for Navigation and Browsing in a Set of Document



- As close as possible to a real world-book

[S.K. Card et al. (1996)]



4.0 The CommonKADS Methodology

Knowledge Management Methodology: CommonKADS

[Schreiber et al. 99]

4.0 The CommonKADS Methodology

- Why Methodology?
 - Guidance for developing a KM System or Introducing a KM System in the Organization
 - Definition of Templates
 - Can be supported by Tools

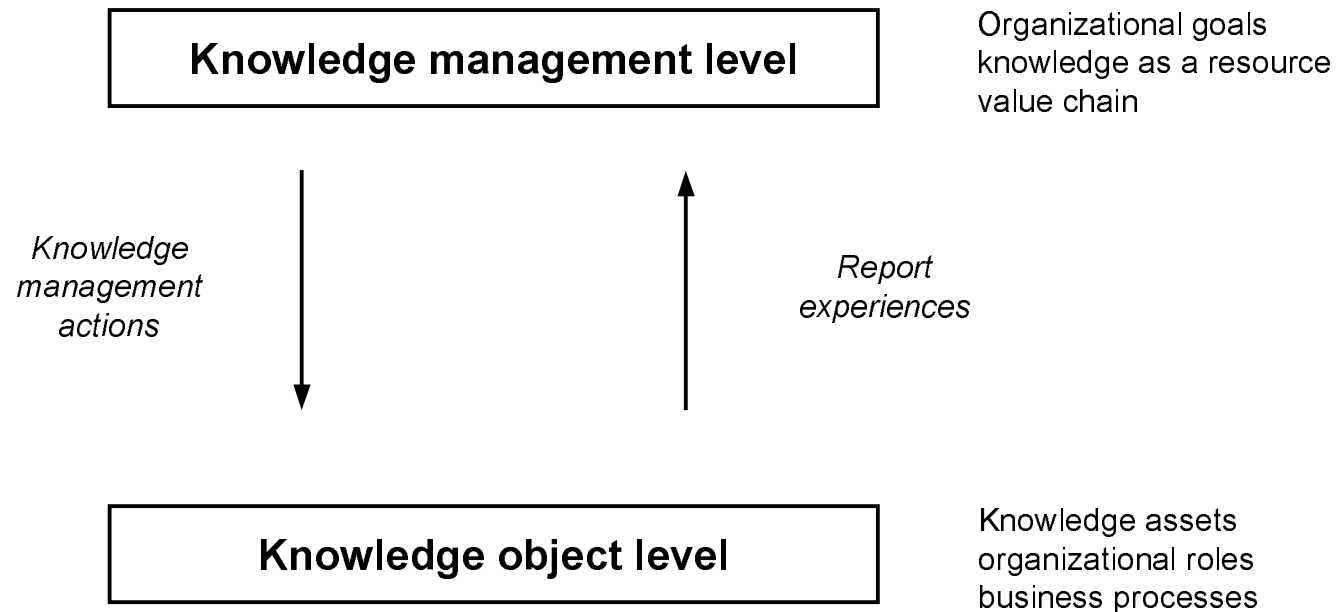
4.0 The CommonKADS Methodology

- CommonKADS is a Knowledge Engineering Methodology (Methodology for developing Knowledge (-Based) Systems)
- Relationship between Knowledge Engineering and Knowledge Management
 - Knowledge Systems are Knowledge Management Methods and Tools of advanced Information
 - Embedding of Knowledge (-Based) Systems have Organizational and Human Resources context

4.0 The CommonKADS Methodology

- Presented parts of CommonKADS
 - The overall knowledge management framework as defined by CommonKADS
 - Those models of the CommonKADS model suite that are relevant for knowledge management
- Approach will be illustrated by a case study

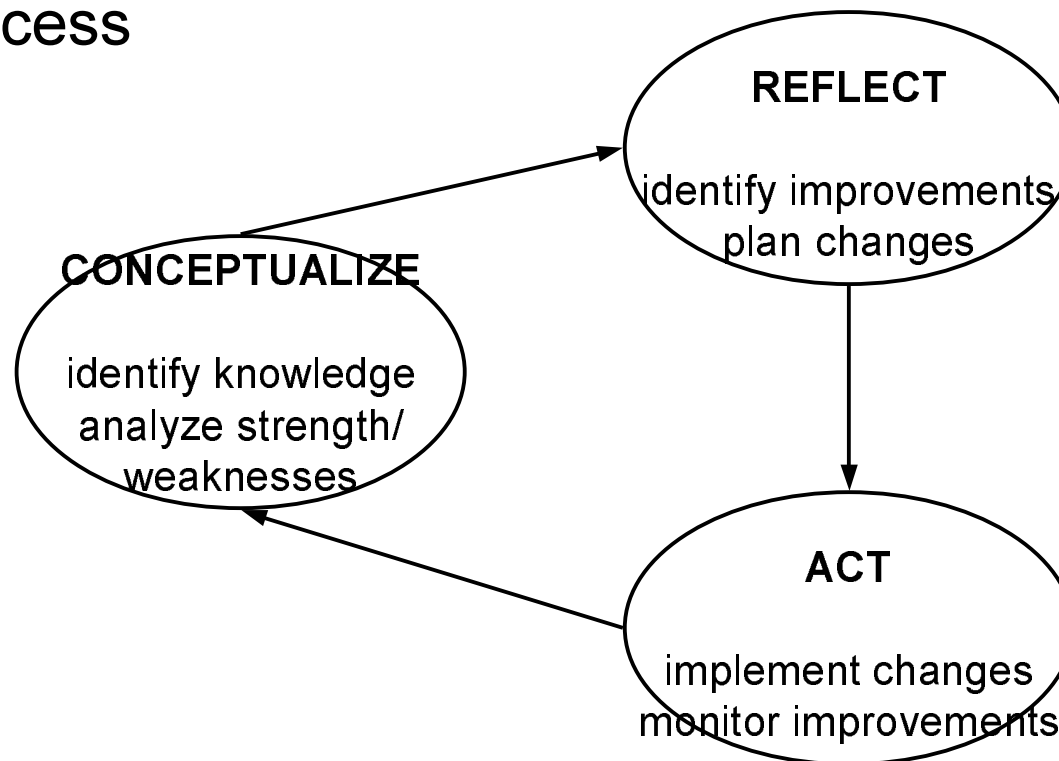
4.1 The Knowledge Managementg FrameWork



Knowledge management, like other management tasks, can be seen as a metalevel activity that acts on an object level.

4.1 The Knowledge Management Framework

- Management level consists of three types of management activities, embedded in a cyclic process

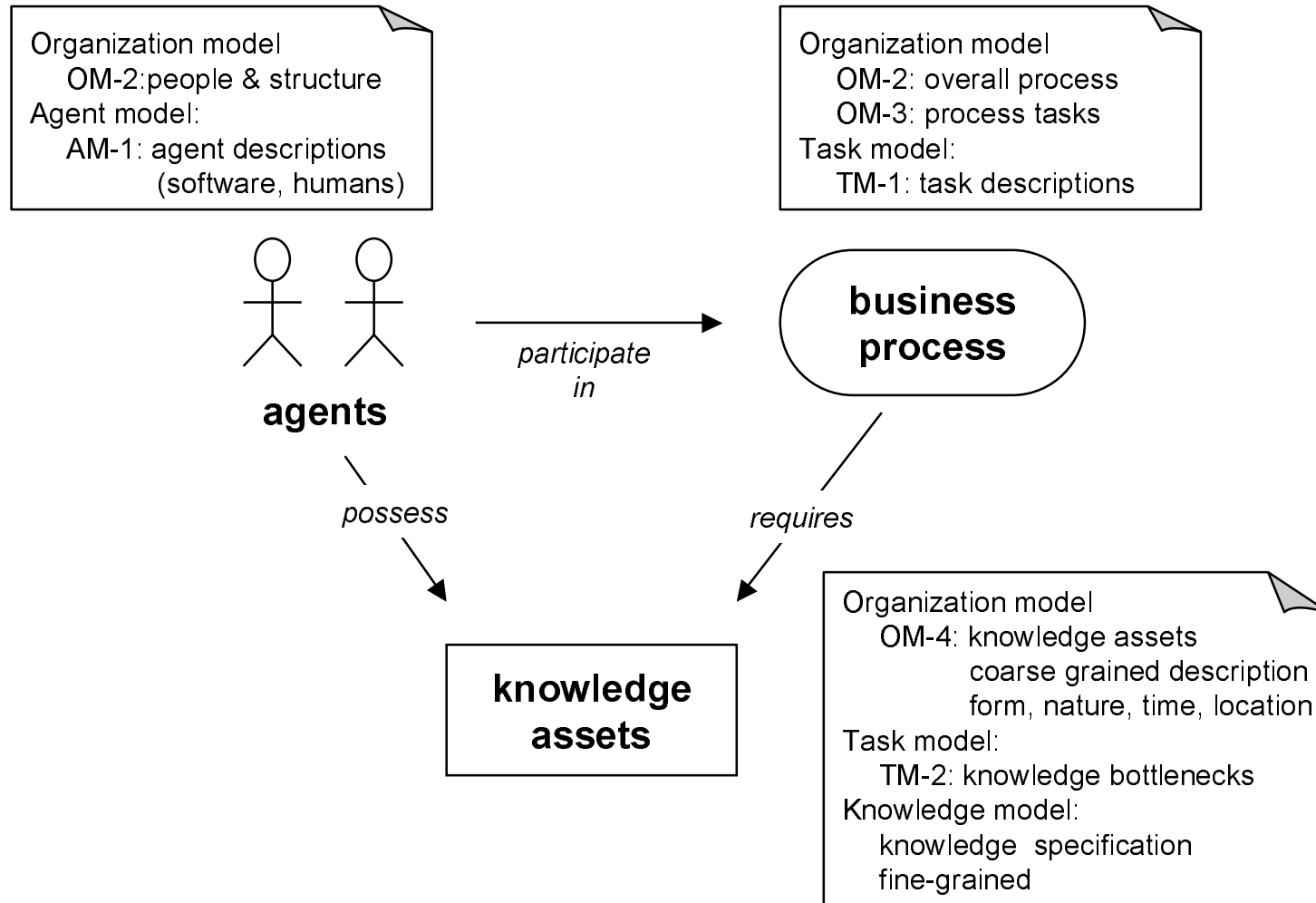


Knowledge management consists of a cyclic execution of three main activities: conceptualize, reflect, and act.

4.1 The Knowledge Management Framework

- Knowledge object level
 - Knowledge object level is composed of
 - **Knowledge assets**
 - **Organizational roles**
 - **Business processes**
 - Some models of the CommonKADS model suite address the relevant aspects:
 - Organization model
 - Agent model
 - Task model

4.1 The Knowledge Management Framework



Knowledge-management actions are defined in terms of three objects: agents that possess knowledge assets and participate in the business process. The notes indicate which parts of the CommonKADS models describe these objects.

4.1 The Knowledge Management Framework

- The analysis of organizational and task aspects is divided in 2 phases:

Phase 1: Scoping and feasibility study

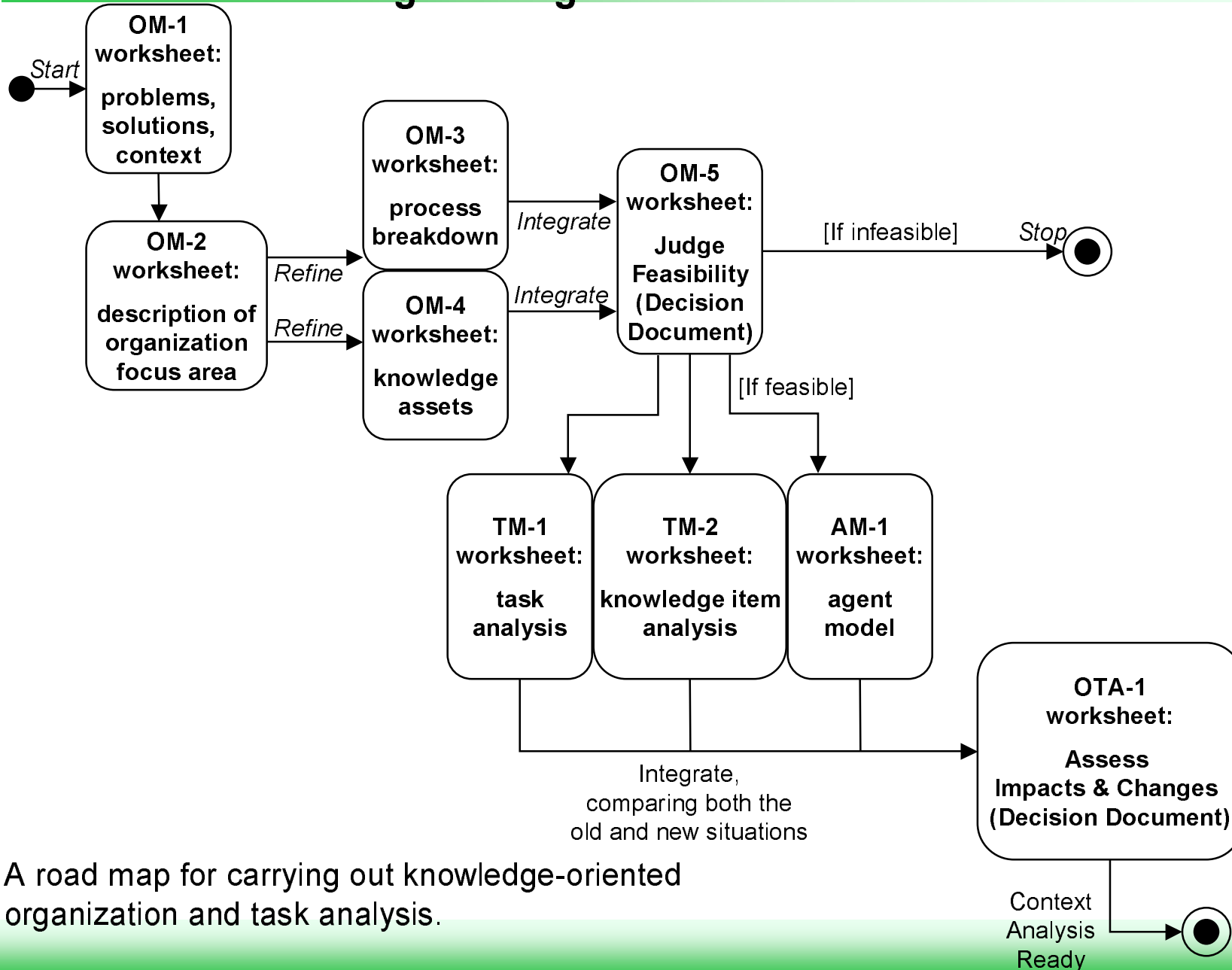
- Identify problem/opportunity areas and potential solutions, embedded into an organizational perspective
 - Oriented towards modeling and analysis
- Decide about economic, organizational, technical feasibility in order to select the most promising focus area
 - Oriented towards managerial decision making
- Organization model is used for this purpose

4.1 The Knowledge Management Framework

Phase 2: Impact and improvement study

- **Gather insights into the interrelationship between task, agents involved and use of knowledge and potential improvements**
 - Oriented towards modeling and analysis
- **Identify required organizational measures and task changes in order to ensure organizational acceptance**
 - Oriented towards managerial decision making
- **Two models are offered**
 - Task model
 - Agent model

4.1 The Knowledge Management Framework



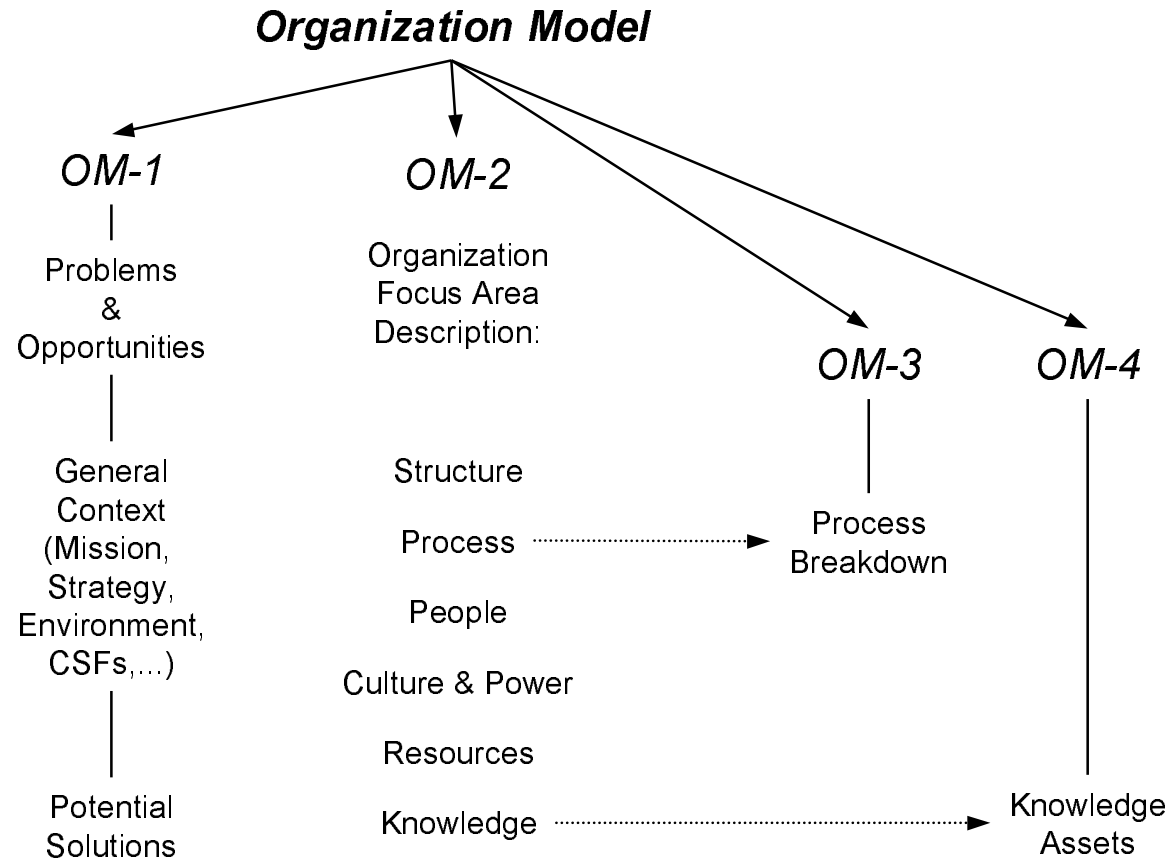
A road map for carrying out knowledge-oriented organization and task analysis.



4.2 Organizational Modeling

- Organization is analyzed from a KM point of view
- Integrate aspects from organization theory, business process analysis, information management
- Model is composed of different components addressing different aspects like
 - Organization structure
 - Processes
 - Staff
 - Resources

4.2 Organizational Modeling



Overview of the components of the CommonKADS organization model.

4.2 Organizational Modeling

Organization Model	Problems and Opportunities Worksheet OM-1
Problems and opportunities	Make a shortlist of perceived problems and opportunities, based on interviews, brainstorm and visioning meetings, discussions with managers, etc.
Organizational context	Indicate in a concise manner key features of the wider organizational context, so as to put the listed opportunities and problems into proper perspective. Important features to consider are: <ol style="list-style-type: none"> 1. Mission, vision, goals of the organization 2. Important external factors the organization has to deal with 3. Strategy of the organization 4. Its value chain and the major value drivers
Solutions	List possible solutions for the perceived problems and opportunities, as suggested by the interviews and discussions held, and the above features of the organizational context.

Worksheet OM-1: Identifying knowledge-oriented problems and opportunities in the organization

4.2 Organizational Modeling

Organizational Model	Variant Aspects Worksheet OM-2
STRUCTURE	Give an organization chart of the considered (part of the) organization in terms of its departments, groups, units, sections,...
PROCESS	Sketch the layout (e.g., with the help of a UML activity diagram) of the business process at hand. A process is the relevant part of the value chain that is focused upon. A process is decomposed into tasks, which are detailed in worksheet OM-3.
PEOPLE	Indicate which staff members are involved, as actors or stakeholders, including decision makers, providers, users or beneficiaries ("customers") of knowledge. These people do not need to be actual people, but can be functional roles played by people in the organization (e.g., director, consultant)

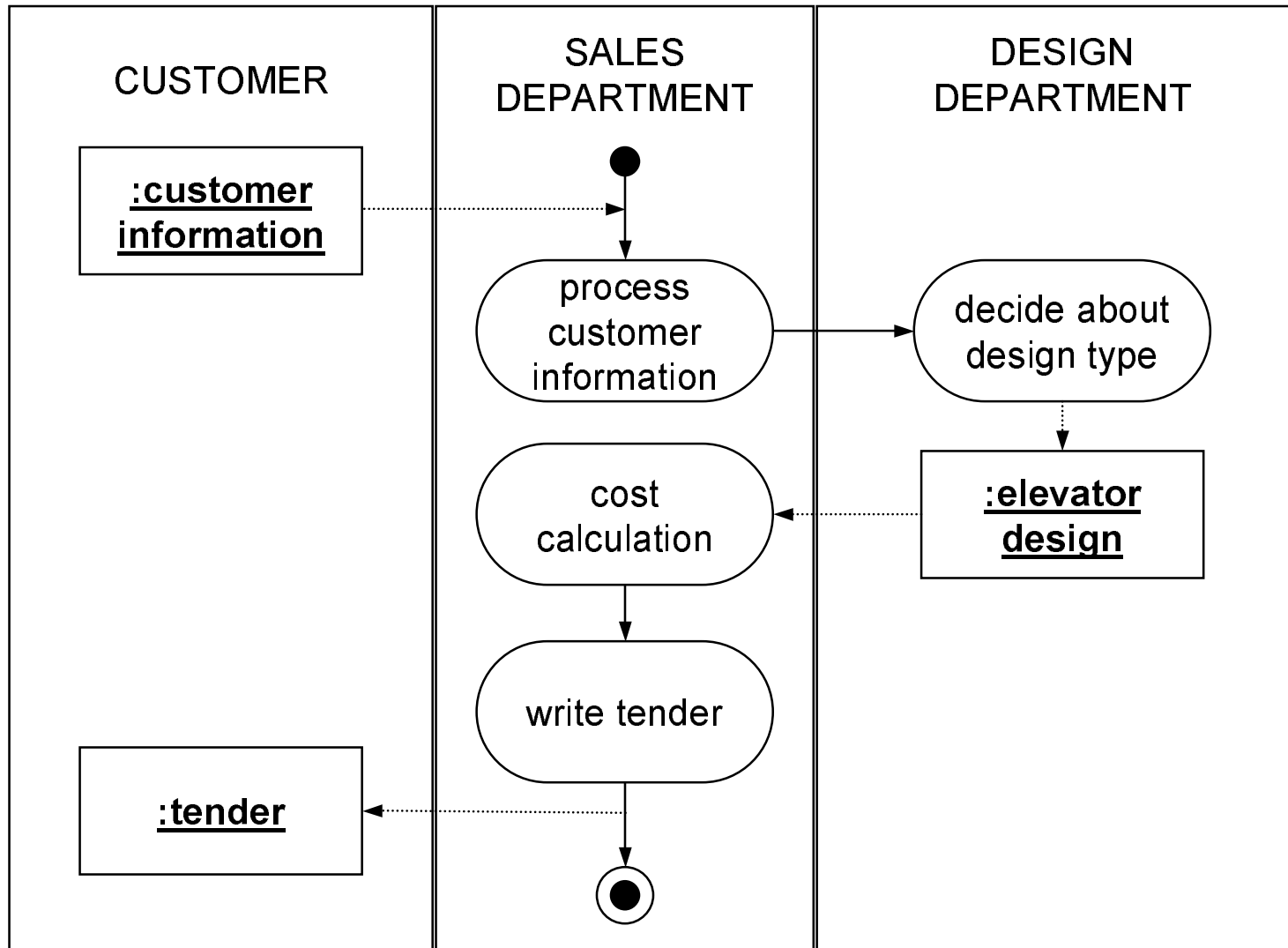
Worksheet OM-2: Description of organizational aspects that have an impact on and/or are affected by chosen knowledge solutions. (Part I)

4.2 Organizational Modeling

Organizational Model	Variant Aspects Worksheet OM-2 (continued)
RESOURCES	Describe the resources that are utilized for the business process. These may cover different types, such as: <ol style="list-style-type: none"> 1. Information systems and other computing resources 2. Equipment and materials 3. Technology, patents, rights
KNOWLEDGE	Knowledge represents a special resource exploited in a business process. Because of its key importance in the present context, it is set apart here. The description of this component of the organization model is given separately, in worksheet OM-4 on knowledge assets.
CULTURE & POWER	Pay attention to the unwritten rules of the game, including styles of working and communicating ("the way we do things around here"), related social and interpersonal (nonknowledge) skills, and formal as well as informal relationships and networks.

Worksheet OM-2: Description of organizational aspects that have an impact on and/or are affected by chosen knowledge solutions. (Part II)

4.2 Organizational Modeling



Business process of a company designing and selling elevators, specified through a UML activity diagram

4.2 Organizational Modeling

Organization Model		Process Breakdown Worksheet OM-3				
NO.	TASK	PER-FORMED BY	WHERE?	KNOWL-EDGE ASSET	INTEN-SIVE?	SIGNIFI-CANCE
Task identifier	Task name (some part of the process in OM-2)	A certain agent, either a human (see „People“ in OM-2) or a software system (see „Resource“ in OM-2)	Some location in the organization structure (see OM-2)	List of knowledge resources used by this task	Boolean indicating whether the task is considered knowledge-intensive?	Indication of how significant the task is considered to be (e.g., on a five point scale in terms of frequency, costs, resources or mission criticality)

Worksheet OM-3: Description of the process in terms of the task of which it is composed.

4.2 Organizational Modeling

First overview about important knowledge assets

Organization Model		Knowledge Assets Worksheet OM-4				
KNOWL- EDGE ASSET	POS- SESSED BY	USED IN	RIGHT FORM?	RIGHT PLACE?	RIGHT TIME?	RIGHT QUALITY?
Name (cf. worksheet OM-3)	Agent (cf. worksheet OM-3)	Task (cf. worksheet OM-3)	(Yes or no; comments)	(Yes or no; comments)	(Yes or no; comments)	(Yes or no; comments)

Worksheet OM-4: Description of the knowledge component of the organization model.

4.2 Organizational Modeling

Organizational Model	Checklist for Feasibility Decision Document: Worksheet OM-5
BUSINESS FEASIBILITY	<p>For a given problem/opportunity area and a suggested solution, the following question have to be answered:</p> <ol style="list-style-type: none"> 1. What are the expected benefits for the organization form the considered solution? Both tangible economic and intangible business benefits should be identified here. 2. How large is this expected added value? 3. What are the expected costs for the considered solution? 4. How does this compare to possible alternative solutions? 5. Are organizational changes required? 6. To what extent are economic and business risks and uncertainties involved regarding the considered solution direction?
TECHNICAL FEASIBILITY	<p>For a given problem/opportunity area and a suggested solution, the following questions have to be answered:</p> <ol style="list-style-type: none"> 1. How complex, in terms of knowledge stored and reasoning processes to carried out, is the task to be performed by the considered knowledge-system solution? Are state-of-the-art methods and techniques available and adequate? 2. Are there critical aspects involved, relating to time, quality, needed resources, or otherwise? If so, how to go about them? 3. Is it clear what the success measures are and how to test for validity, quality, and satisfactory performance? 4. How complex is the required interaction with end users (user interfaces)? Are stat-of-the-art methods and techniques available an adequate? 5. How complex is the interaction with other information systems and possible other resources (interoperability, systems integration)? Are stat-of-the-art methods and techniques available an adequate? 6. Are there further technical risks and uncertainties?

Worksheet OM-5: Checklist for the feasibility decision document (Part I).

4.2 Organizational Modeling

Organizational Model	Checklist for Feasibility Decision Document: Worksheet OM-5 (continued)
PROJECT FEASIBILITY	<p>For a given problem/opportunity area and a suggested solution, the following question have to be answered:</p> <ol style="list-style-type: none"> 1. Is there adequate <i>commitment</i> from the actors and stakeholders (managers, experts, users, customers, project team members) for further project steps? 2. Can the needed <i>resources</i> in terms of time, budget, equipment, staffing be made available? 3. Are the required <i>knowledge</i> and other <i>competences</i> available? 4. Are the <i>expectations</i> regarding the project and its results realistic? 5. Are the <i>project organization</i> and its internal as well as external <i>communication</i> adequate? 6. Are there further project risks and uncertainties?
PROPOSED ACTIONS	<p>This is the part of the feasibility decision document that is directly subject to managerial commitment and decision making. It weights and integrates the previous analysis results into recommended concrete steps for action:</p> <ol style="list-style-type: none"> 1. <i>Focus</i>: What is the recommended focus in the identified problem/opportunity areas? 2. <i>Target solution</i>: What is the recommended solution direction for this focus area? 3. What are the expected <i>results</i>, <i>costs</i>, and <i>benefits</i>? 4. What <i>project actions</i> are required to get there? 5. <i>Risks</i>: If circumstances inside or outside the organization change, under what <i>conditions</i> is it wise to reconsider the proposed decisions?

Worksheet OM-5: Checklist for the feasibility decision document (Part II).

4.2 Organizational Modeling

Remarks

- CommonKADS approach is biased towards initiating a development project for a knowledge (-based) system
- Feasibility has to include aspects like
 - Are the required organizational changes feasible?
 - Are the required changes for human resource management feasible?



5 Case Study

The Chemical Information Network - CIN

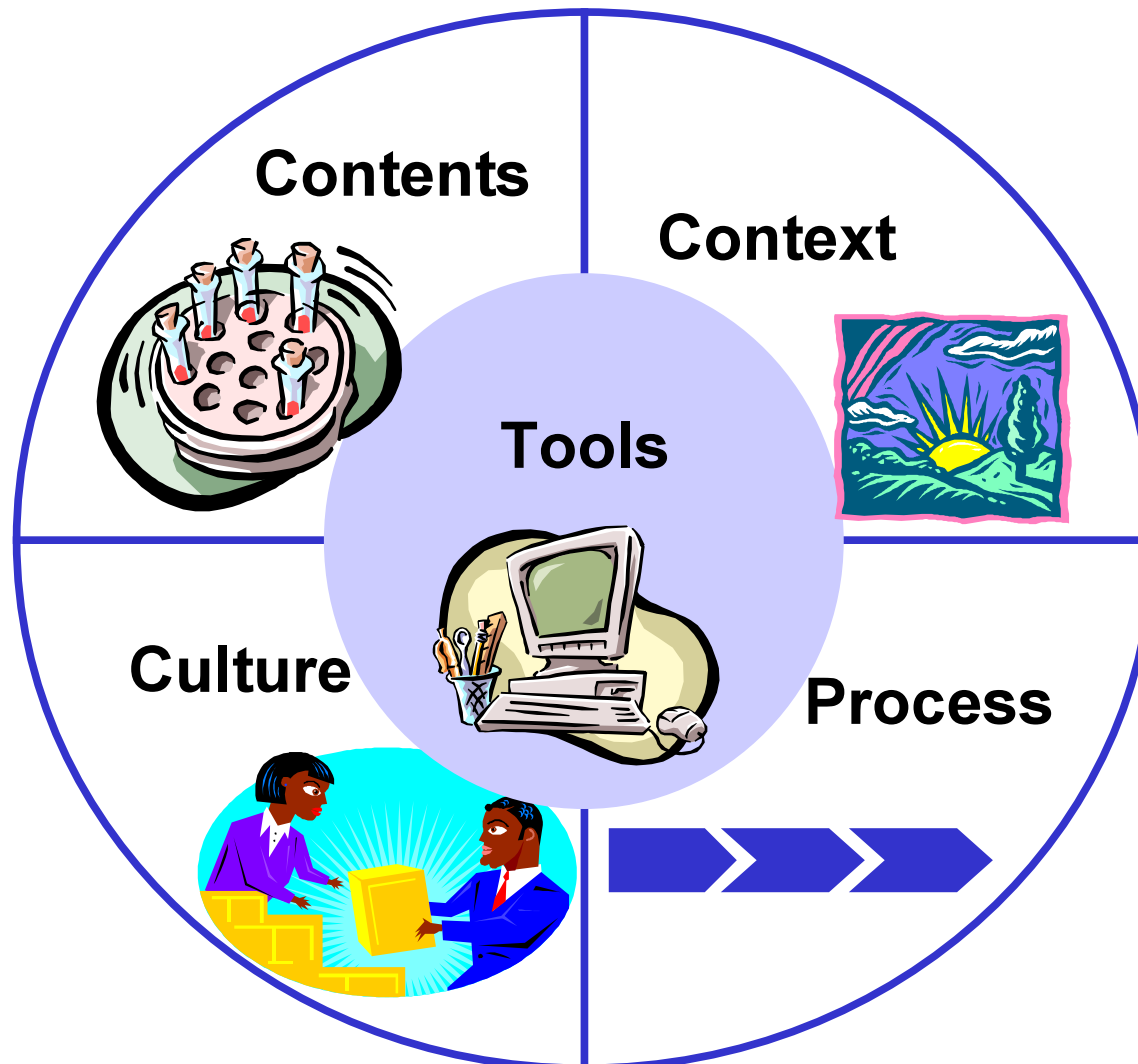


4 Case Study Scenario

- Global consulting company
- High fluctuation of experts
- Many projects
- Many clients

4 Case Study

Foundations for CIN



4 Case Study

Foundations for CIN

- Culture - Open Door (in spite of high workload)
- Content
 - new, innovative knowledge
 - lessons learned
 - focused on one particular domain area (Chemicals Practice)
- Process
 - Dedicated Knowledge Manager
 - Specific points for debriefings of expert knowledge (touchdowns of projects etc.)
 - Evaluation Process for knowledge pieces

4 Case Study

Foundations for CIN

- Context
 - Thesauri (content-wise, regional thesauri, etc.)
 - Relevant views (which person knows about chemical practice X in South America?; etc.)
- Tools
 - Web-based document management
 - metadata about documents
(or “empty documents”, i.e. just facts structured according to thesaurus)
 - thesaurus-based information retrieval

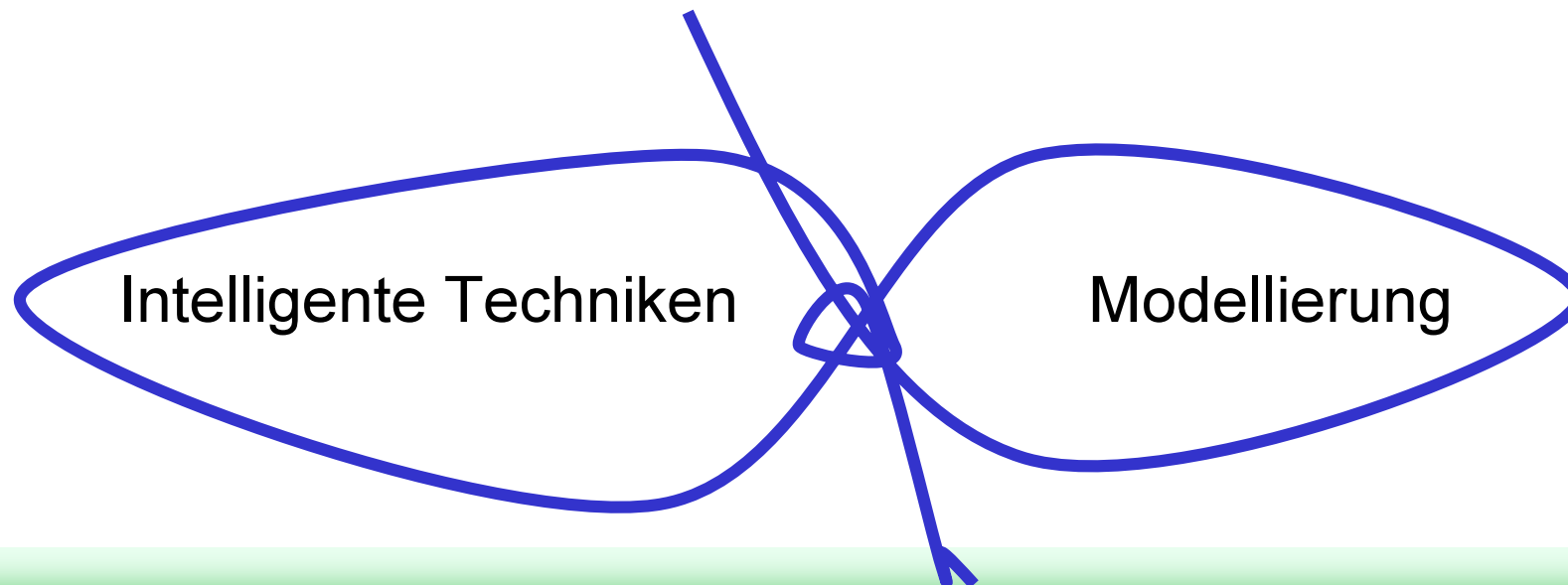
4 Case Study

Outcome

- Everyday practice!!!!
- Significant performance improvements of consulting business
- Knowledge base represents an explication of formerly implicit knowledge, measures allow evaluation of strategy!!

Outlook

- Semantic Web
- E-Learning
- Virtual Enterprises



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Thank You!