The Semantic Web Through Business Information Systems Glasses

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About the speaker: Dr. Martin Hepp

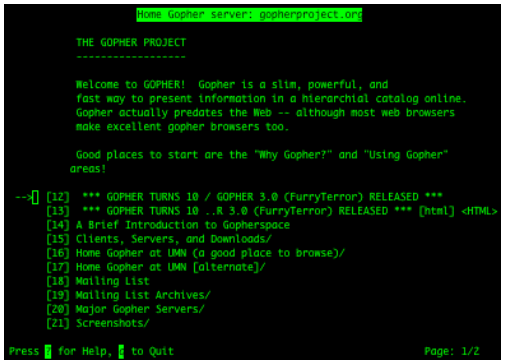
- **Senior Researcher** and Cluster Leader „Semantics in Business Information Systems“ at **DERI**, University of Innsbruck.
- Ph.D. in Management Information Systems, Bayerische Julius-Maximilians-Universität, Würzburg, Germany (2003); M.B.A., ditto, Würzburg, Germany (1999)

See **http://www.heppnetz.de** for current papers and presentations.

1. Prolog: The Semantic Web on two slides...

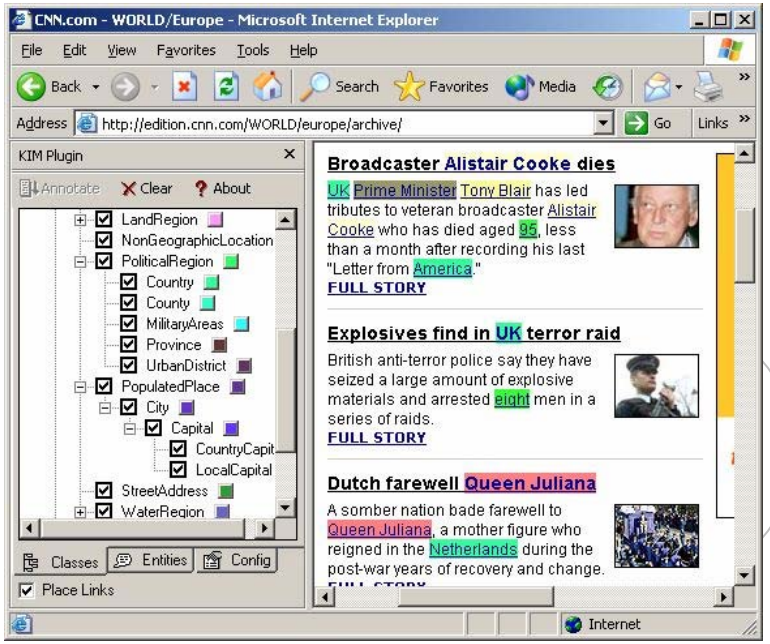
What is the Semantic Web?

The Gopher – HTTP/HTML Analogy



1990: Gopher
Textual information

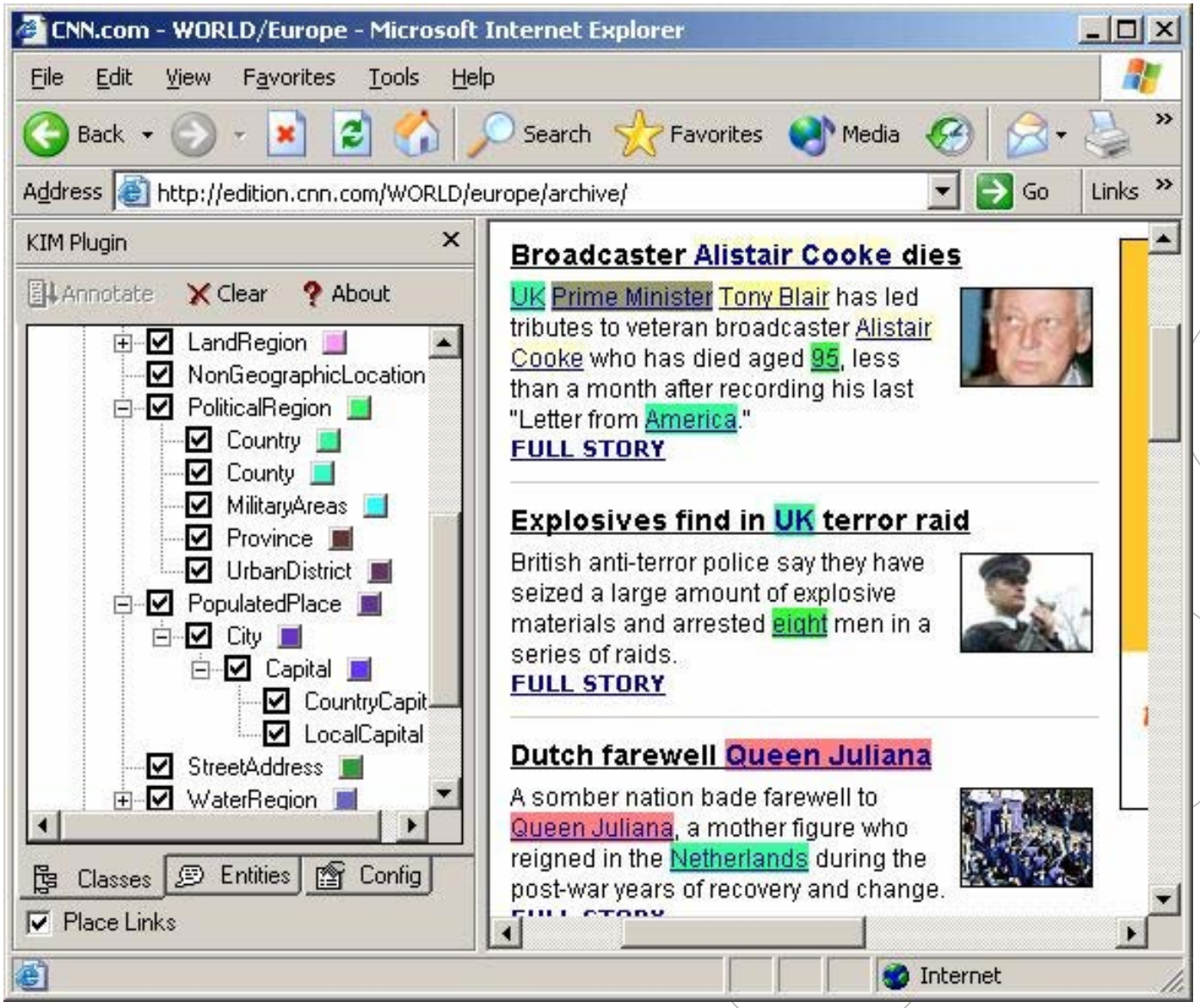
mid 1990s: HTML
Multimedia added



2006 and beyond: RDF, OWL
Meaning added

Gopher screenshot courtesy of the University of Minnesota.
Semantic Web screenshot courtesy of Ontotext, http://www.ontotext.com

The Semantic Web: Embedding Machine-accessible Meaning



The Backbone of the Semantic Web: Ontologies

- Ontology: A shared understanding of some domain of interest.
- An ontology necessarily entails or embodies some sort of world view with respect to a given domain.
- Often in the form of a set of
  - concepts (entities, attributes, processes),
  - their definitions, and
  - their inter-relationships.
- This is called a „conceptualization“.

from: Uschold/Gruninger: Ontologies: Principles, Methods and Applications, 1996

Ontologies: Degree of Formality

- highly informal
- semi-informal
- semi-formal
- rigorously formal

from: Uschold/Gruninger: Ontologies: Principles, Methods and Applications, 1996

There is no myontology.com!

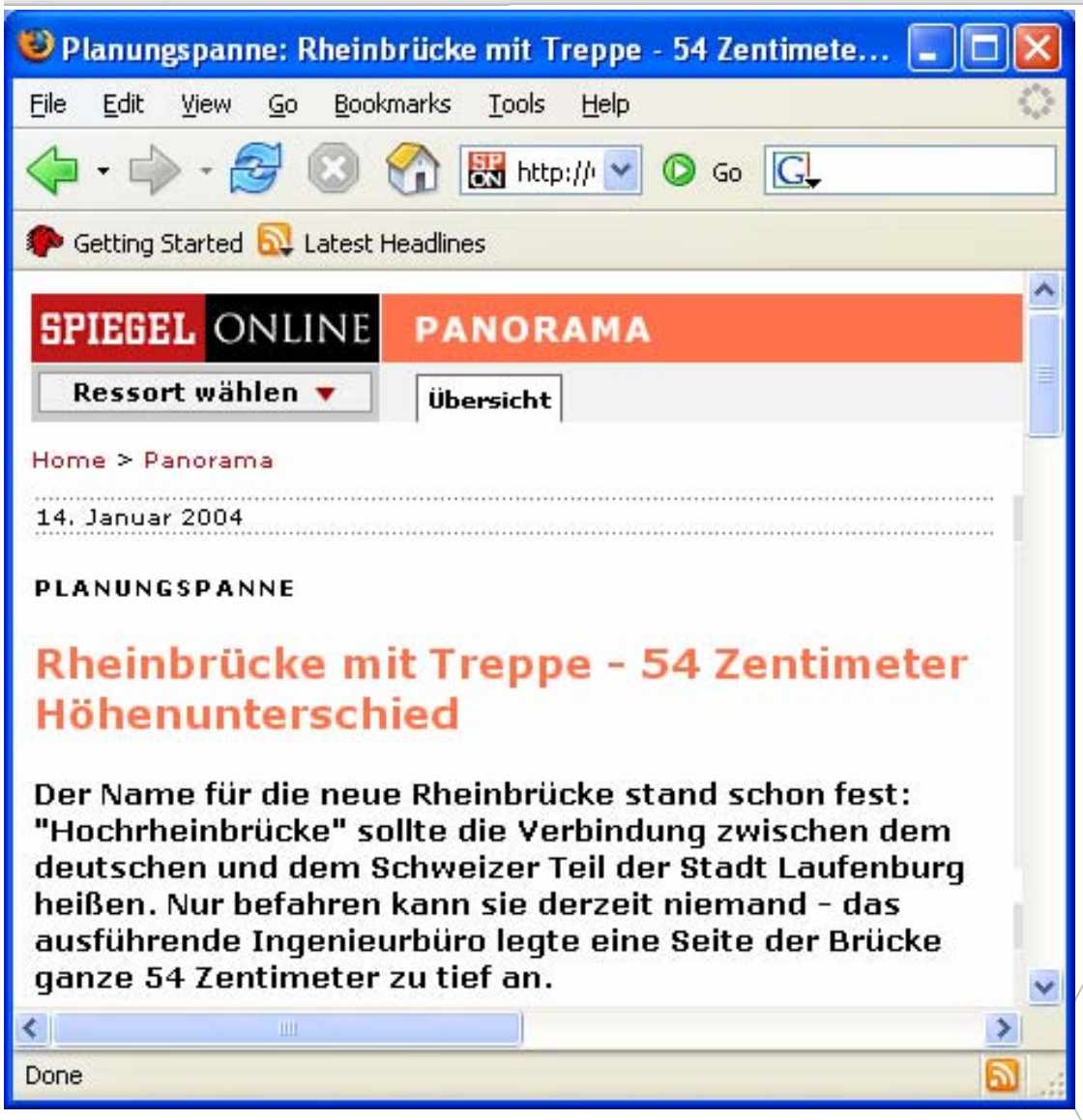
Ontologies are inherently reflecting some degree of community consensus!

What is Information Systems all about?

Creating consensual models of some domain!

2. What has happened so far, and why we cannot continue this way...

Status Quo: Lack of Formal Semantics



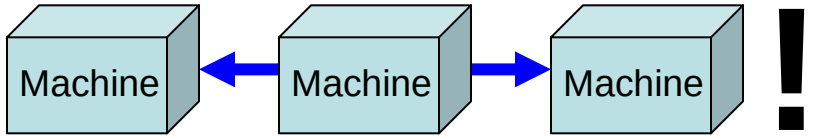
CH: Altitude relative to the **sea level of the Mediterranean Sea.**
D: Altitude relative to the **sea level of the North Sea.**

Gap: 27 cm

27 - (-27) = 54 ☺

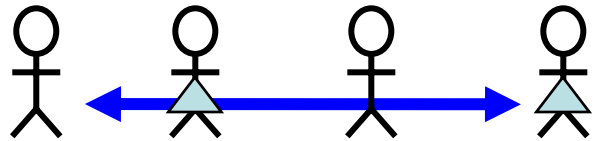
Lack of semantic consensus is a **dangerous mixture when both computers and humans are involved.**

No Problem



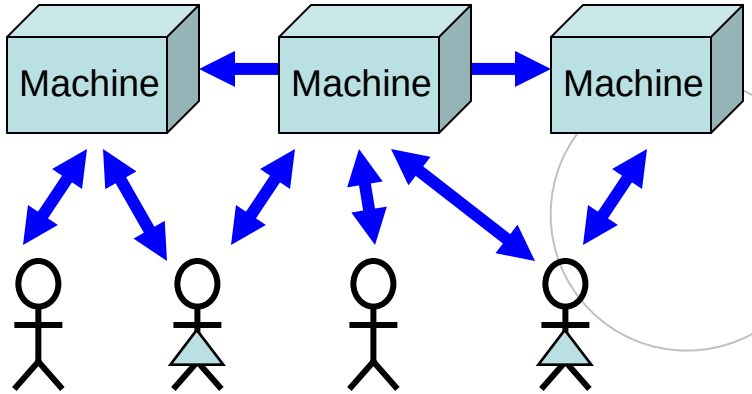
!

Small Problem



Actor 1 Actor 2 Actor 3 Actor 4

Big Problem



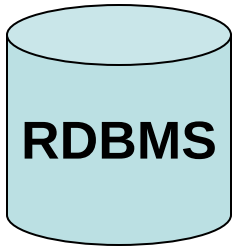
Actor 1 Actor 2 Actor 3 Actor 4

Ontologies:
Making Representational Consensus Explicit

Milestones in Systems Integration

Relational Data Model & RDBMS

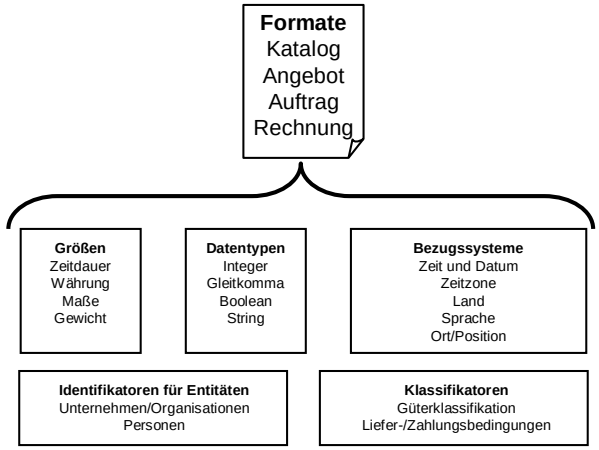
„One fact in one place“

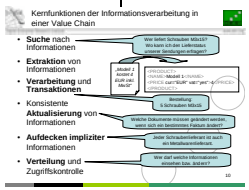


Edgar Frank (Ted) Codd
(1923 – 2003)

\+

Standards





- Consistent data models and standardization simplify automation.
- Very suitable inside one organization and for the integration of *few, lasting* partners.

We have to live with data and protocol, in general: modeling heterogeneity, because...

- Consensus takes time (vs. agility)
- Consensus costs money (vs. small business opportunities)
- Organizations are members of multiple value chains with possibly conflicting requirements (e.g. level of detail vs. bandwidth)

Information Systems as a discipline needs what Semantic Web technology can offer.

...however

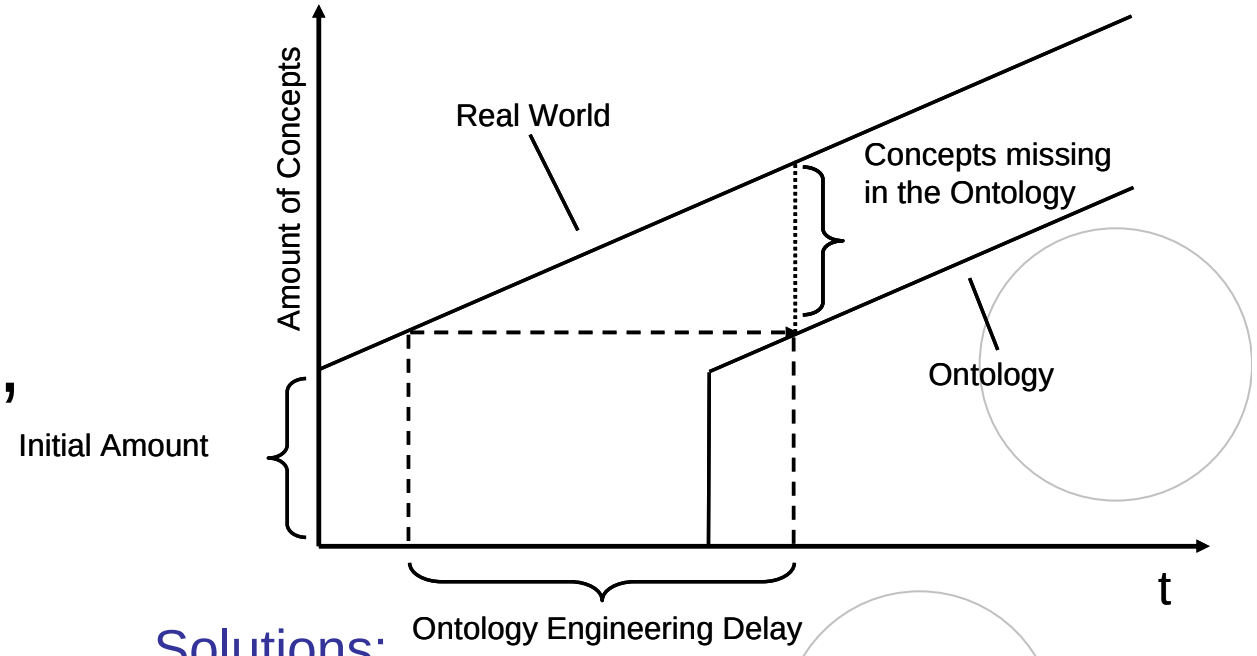
The Semantic Web community will not fulfill its promise without learning from Information Systems as a discipline.

What the Semantic Web Community Did‘t Cater for

- Change
- Cost
- Lags
- Agency Problems
- The Strategic Nature of Information

Issue 1: Conceptual Dynamics and Ontology Maintenance

- The world keeps on turning…
- New classes, relations, instances,…
- A really significant problem, proven with data.



Solutions:

1. Community-driven Ontology Engineering
2. Semi-automated Ontology Engineering
3. Revise the relationship between statistical and descriptive approaches

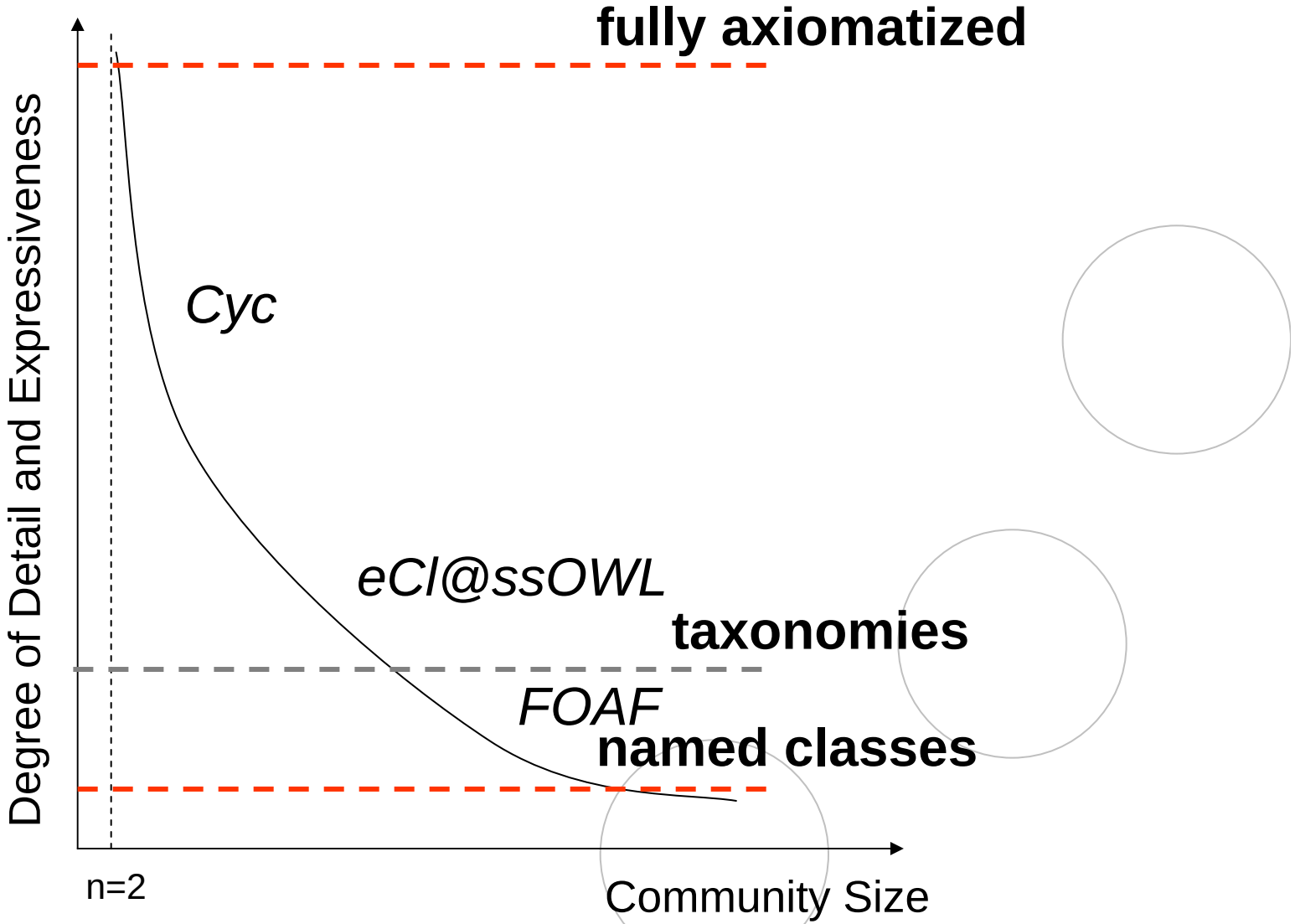
Change Dynamics in Business Vocabularies

	Release	Previous release	New classes per 30 days	Mean	Modified classes per 30 days	Mean
eCl@ss	5.0	4.1	865.0	279.6	157.4	1271.4
	5.0SP1	5.0	47.8		10.2	
	5.1beta	5.0SP1	131.6		4918.0	
	5.1de	5.1beta	74.1		0.0	
eOTD	10-01-2003	01-17-2003	6.1	6.2	0.0	0.0
	11-01-2003	10-01-2003	4.8		0.0	
	03-01-2004	11-01-2003	18.3		0.0	
	06-01-2004	03-01-2004	1.6		0.0	
	08-01-2004	06-01-2004	0.0		0.0	
RNTD	2.0	1.4	0.7	1.3	6.4	1.5
	3.0	2.0	2.4		1.0	
	3.1	3.0	0.0		0.1	
	3.2	3.1	0.0		0.0	
	4.0	3.2	3.4		0.0	
UNSPSC	6,0315	5,1001	907.8	233.9	135.6	47.5
	6,0501	6,0315	304.5		53.0	
	6,0801	6,0501	97.5		15.0	
	6,1101	6,0801	69.1		50.2	
	7,0401	6,1101	13.8		29.4	
	7,0901	7,0401	10.8		2.0	

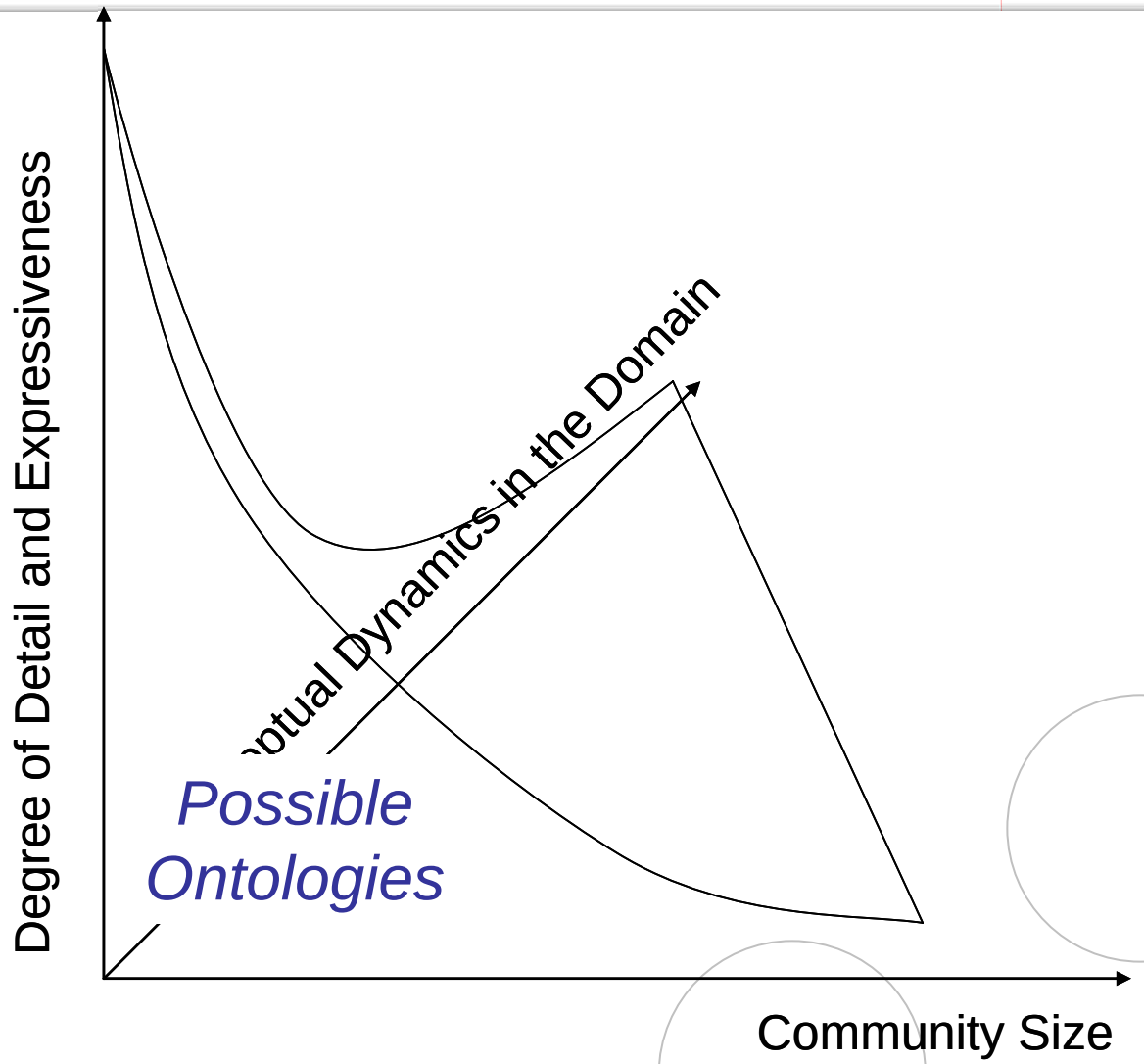
This is only the amount of *actual additions* – the true need for new concepts will be much bigger!

Hepp/Leukel/Schmitz (2005)

Prediction:
The Expressivity-Community-Size Frontier



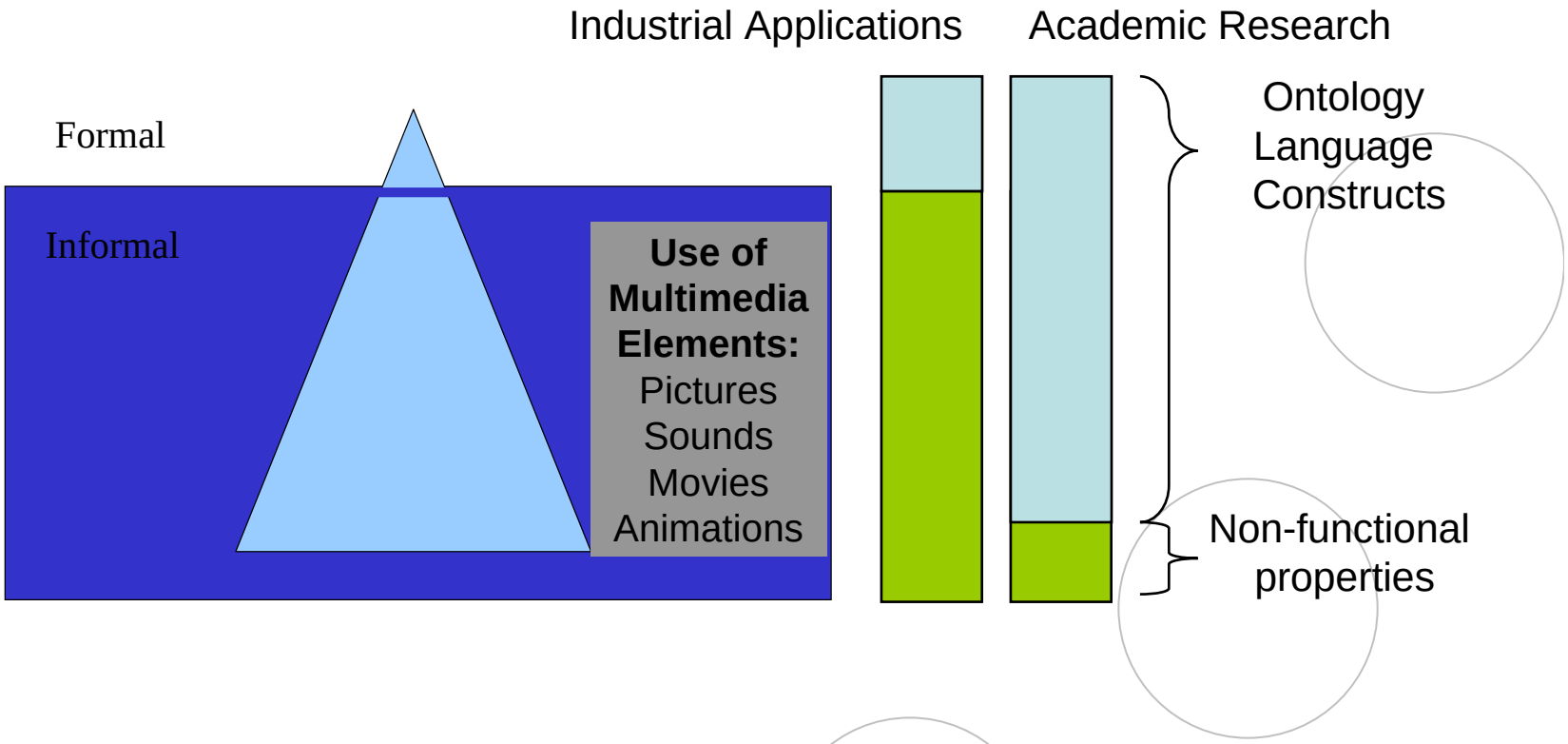
Prediction: Space of Possible Ontologies



Issue 2: Cost vs. Benefit of Ontologies

- Total Cost of an Ontology
- Agency conflicts and incentives in ontology building
- Network effects and diffusion theory

Ontologies: Formal vs. Informal



The Semantic Web Is Now

- Languages
- Methodologies
- (Ontologies)
- Repositories
- (Reasoners)
- Tools

Example: Financial Risk Management (MUSING)

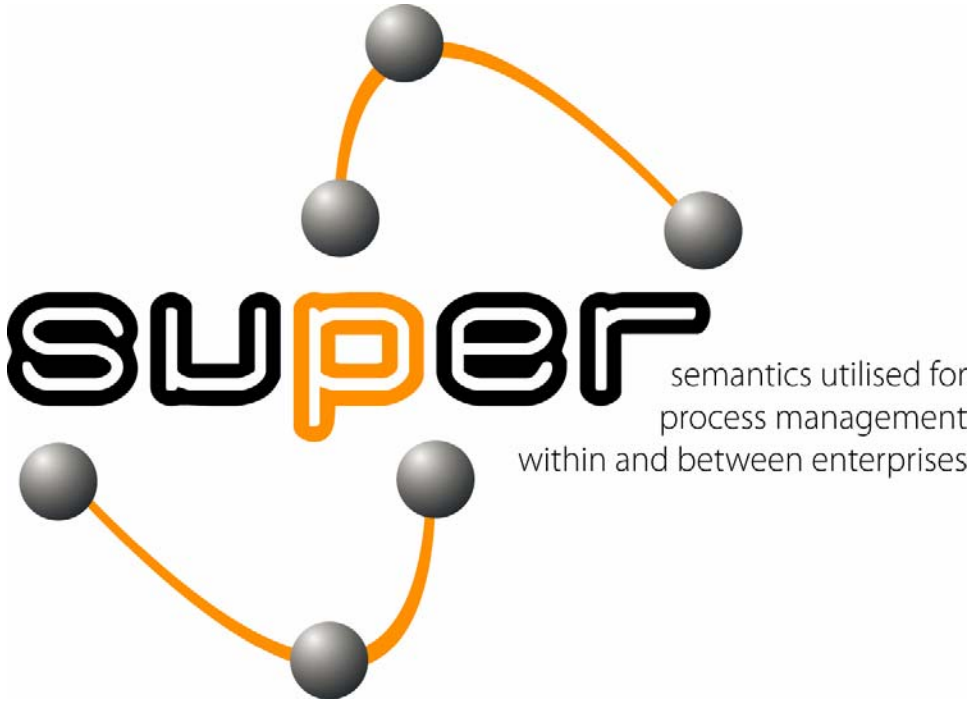
Next Generation
Business Intelligence

- http://musing.metaware.it/

Example: E-Procurement Catalog Data Integration

- http://www.heppnetz.de/eclassowl/

Example: Business Process Management (SUPER)

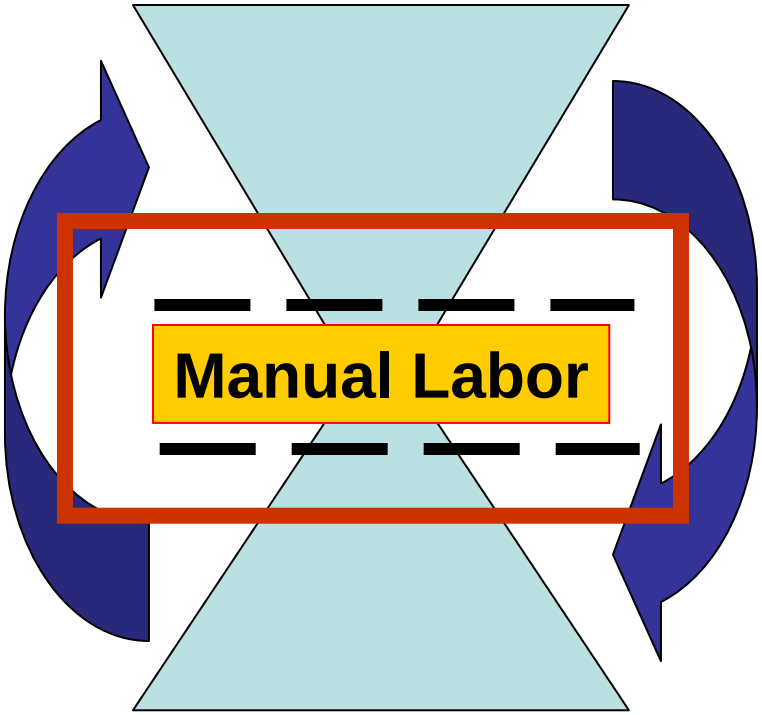


- http://super.semanticweb.org

The Critical IT / Process Divide

Business Experts' Perspective: Processes

Querying the Process Space



Process Implementation

IT Implementation Perspective

Querying the Process Space

"Do we have a cost approval process for items below $ 200?"

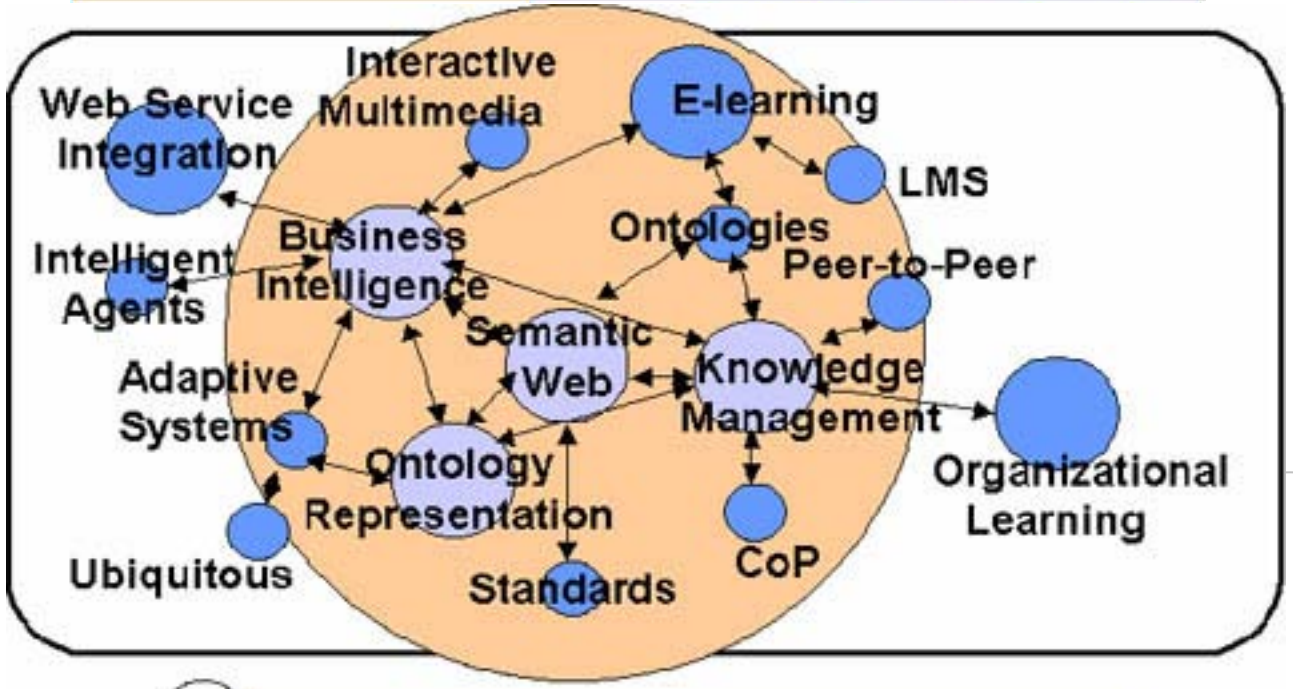
"How many inventory management methods are currently in use?"

"In which of our food manufacturing machines are we processing meat *or* raw eggs?"

Example: Simulation Model Discovery (Industrial Project)

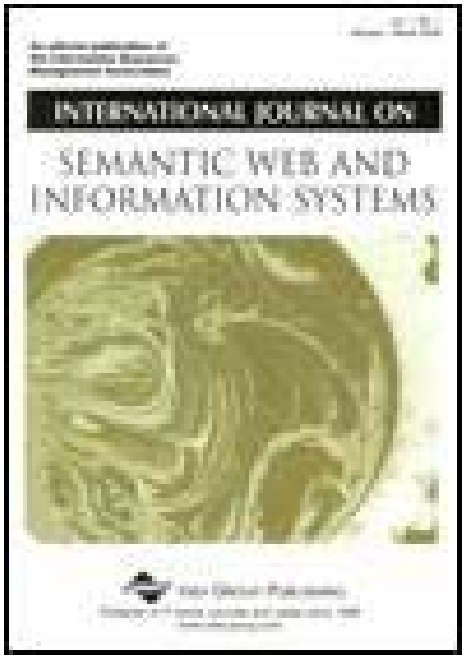
3. The Birth of a New Research Community…

AIS SIGSEMIS: Bringing together MIS and SW communities



- http://www.sigsemis.org

The International Journal on Semantic Web and Information Systems



- http://www.ijswis.org/

First International Workshop on Ontologizing Industrial Standards - OIS 2006

- http://events.deri.at/ois2006/

First International Workshop on Applications and Business Aspects of the Semantic Web (SEBIZ 2006)

in conjunction with the Fifth International Semantic Web Conference (ISWC 2006), November 5 - 9, 2006, Athens, Georgia, USA

- http://www.ag-nbi.de/conf/SEBIZ06

Some Colleagues in IS are not yet listening...

- Comment from a Meistersinger[1] review report in 2004: *„The Semantic Web is irrelevant for Information Systems“*

[1] *A German workshop for Assistant Professors*

But... Innovation means to take new paths before the masses follow ☺

Industry Pick-up - DERI Partners in EU and National Research Projects

Thank you for your attention.

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