Web Information Extraction Systems for Web Semantization

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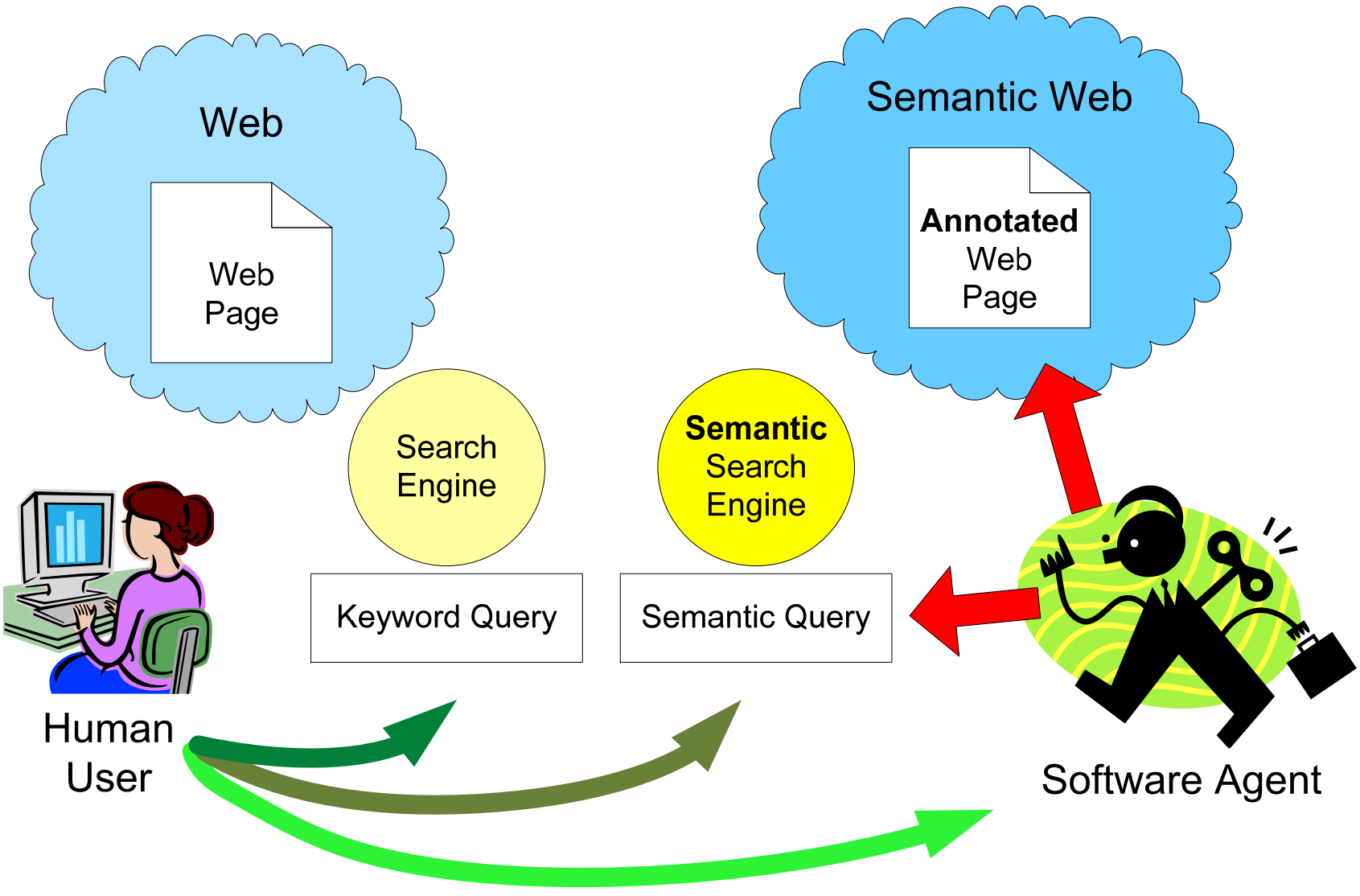
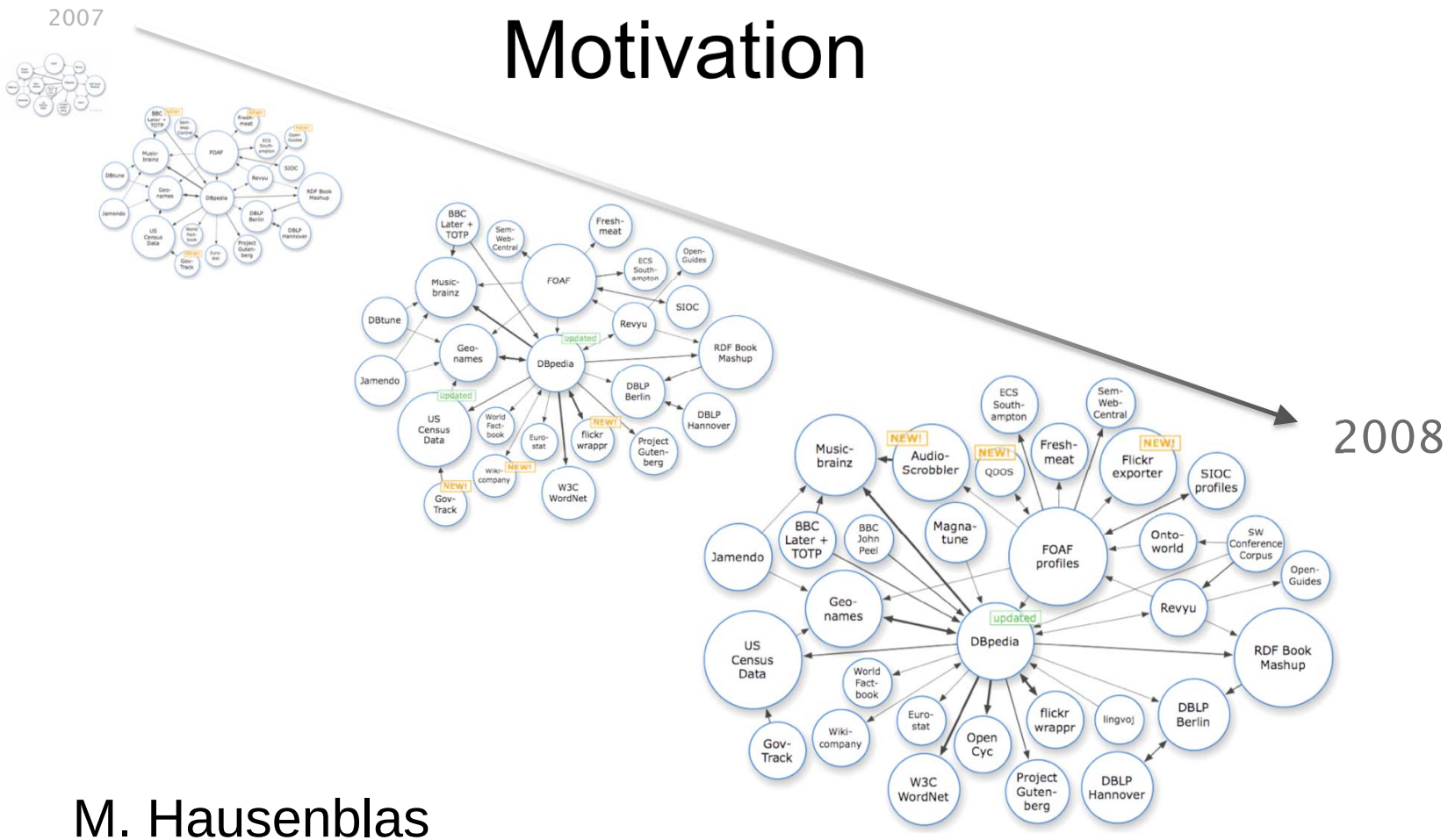
Outline

The Semantic/Semantized Web in Use



Growing of Linking Open Data data set 2007–2008



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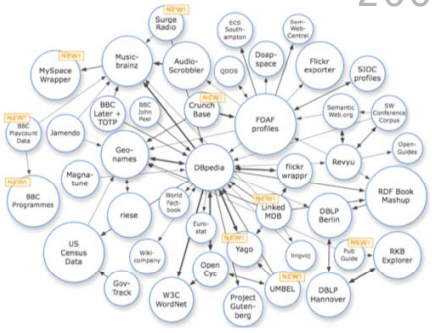
Growing of LOD data set 2008–2009



M. Hausenblas

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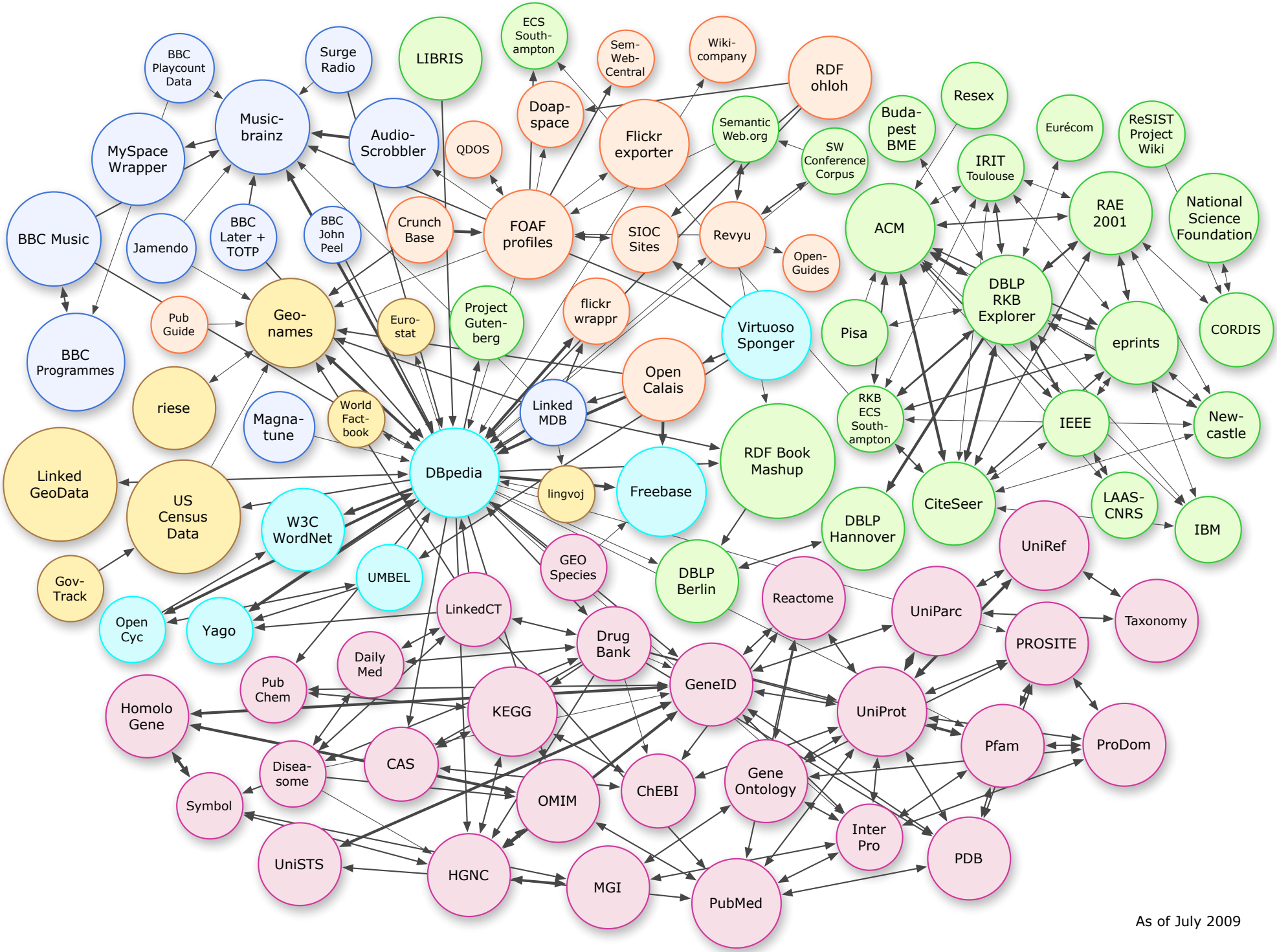
LOD data set statistics as of July 2009

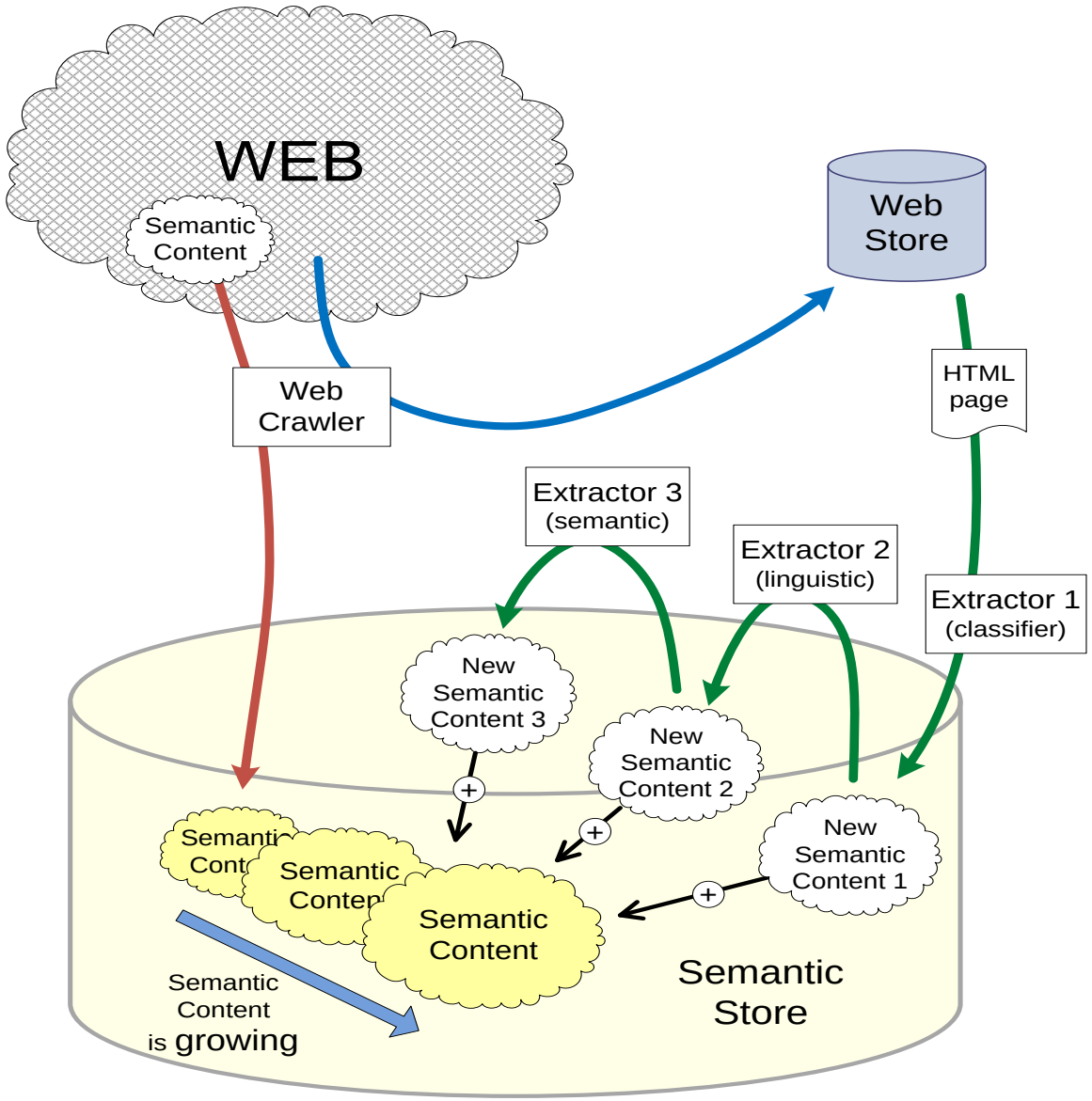
Domain	*No of Triples*	*% of Cloud*	*No of Links*	*% of Links*
Media	698.000.000	10,4%	1.238.000	0,8%
Publications	212.000.000	3,2%	4.922.000	3,3%
Life Sciences	2.429.000.000	36,1%	133.199.000	89,4%
Geographic Data	3.097.000.000	46,0%	4.038.000	2,7%
User Generate Content	76.000.000	1,1%	1.559.000	1,0%
Cross-Domain	214.000.000	3,2%	3.992.000	2,7%
Total	***6.726.000.000***		***148.948.000***	

Christian Bizer: The Web of Linked Data (26/07/2009)

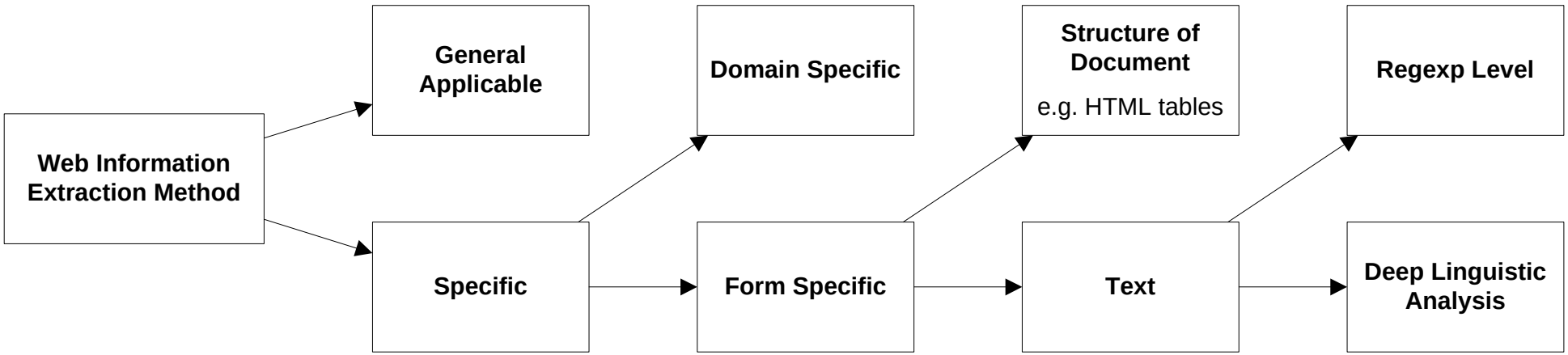


As of July 2009

Web Semantization

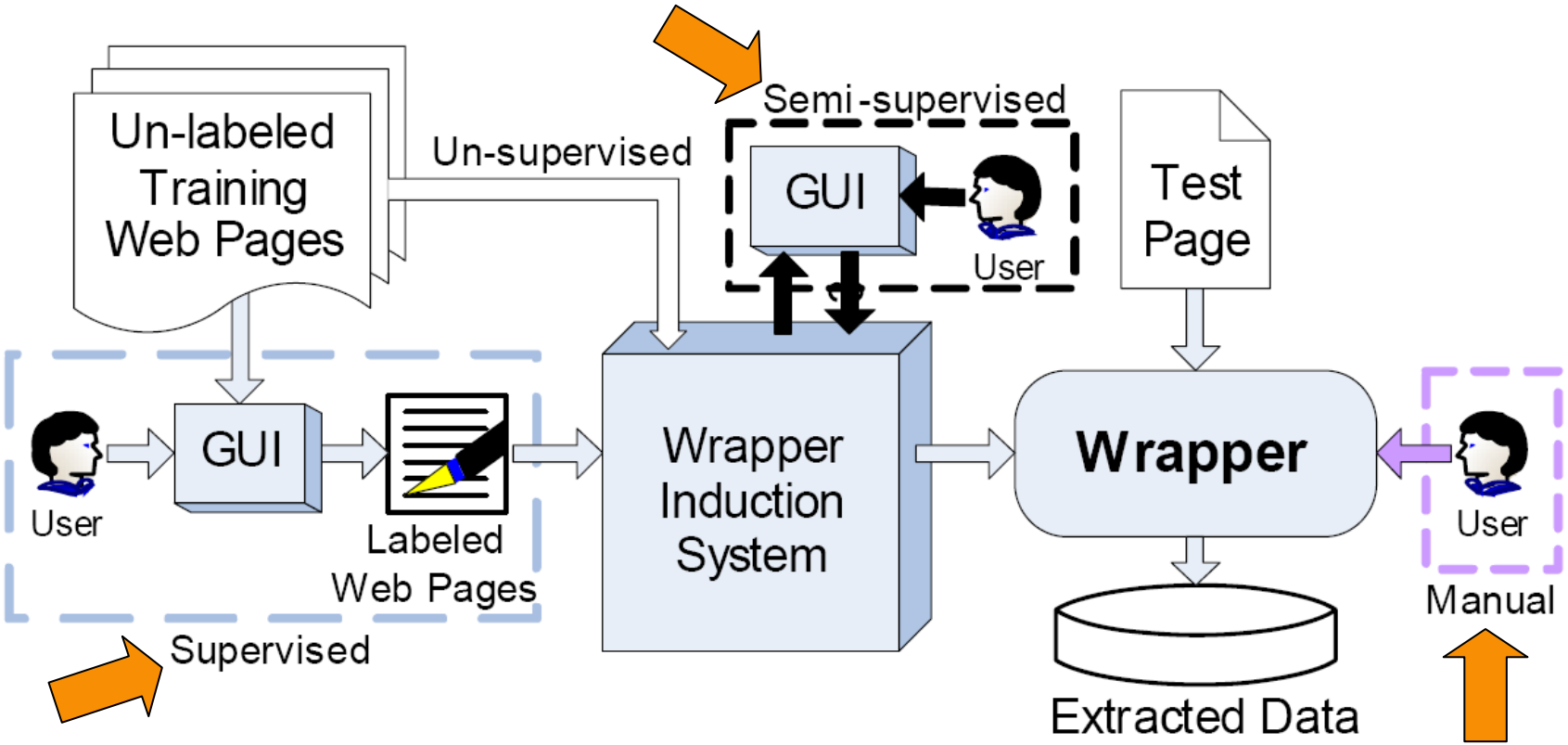


Division of extraction methods



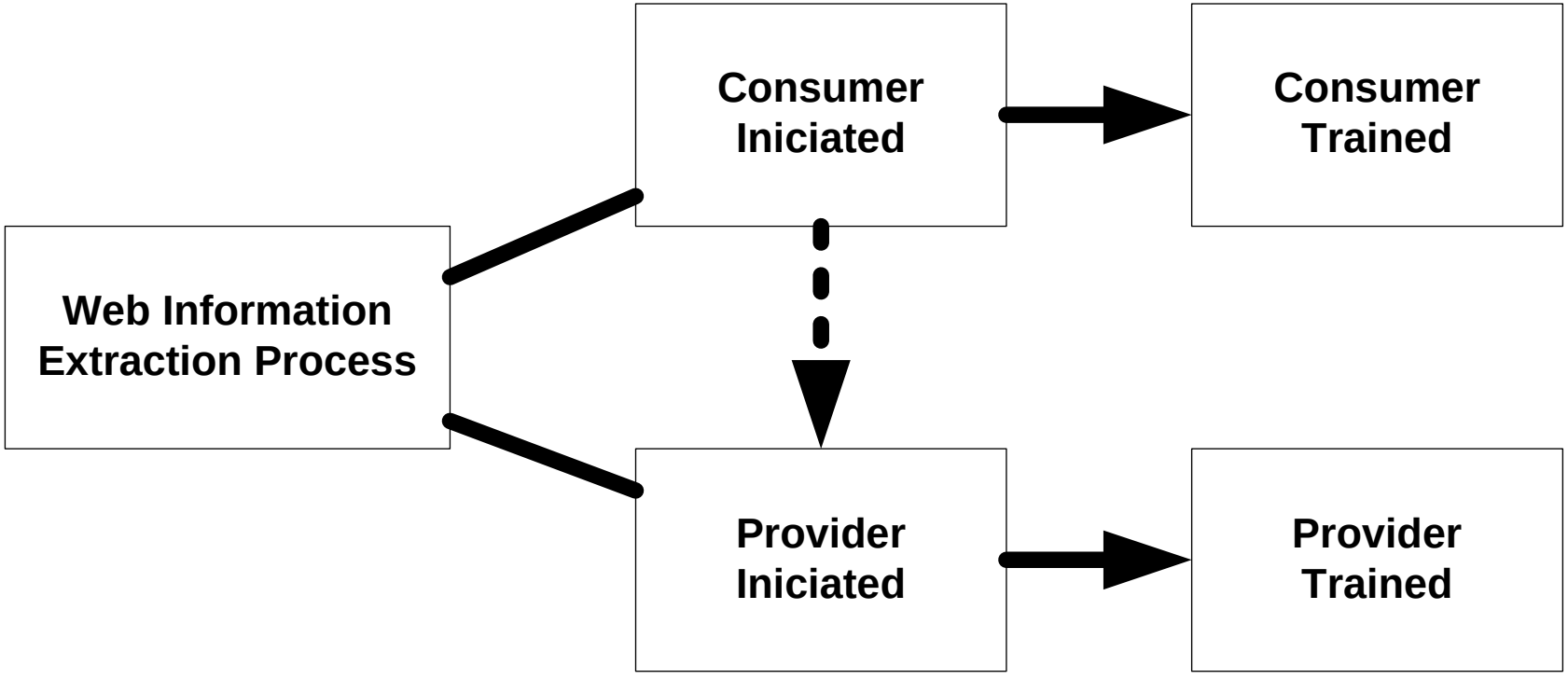
- General Applicable
  - Instance Resolution Task
    - Bootstraping
    - Use of search engines
- Domain Specific
- Form Specific

A general view of WI systems – user perspective



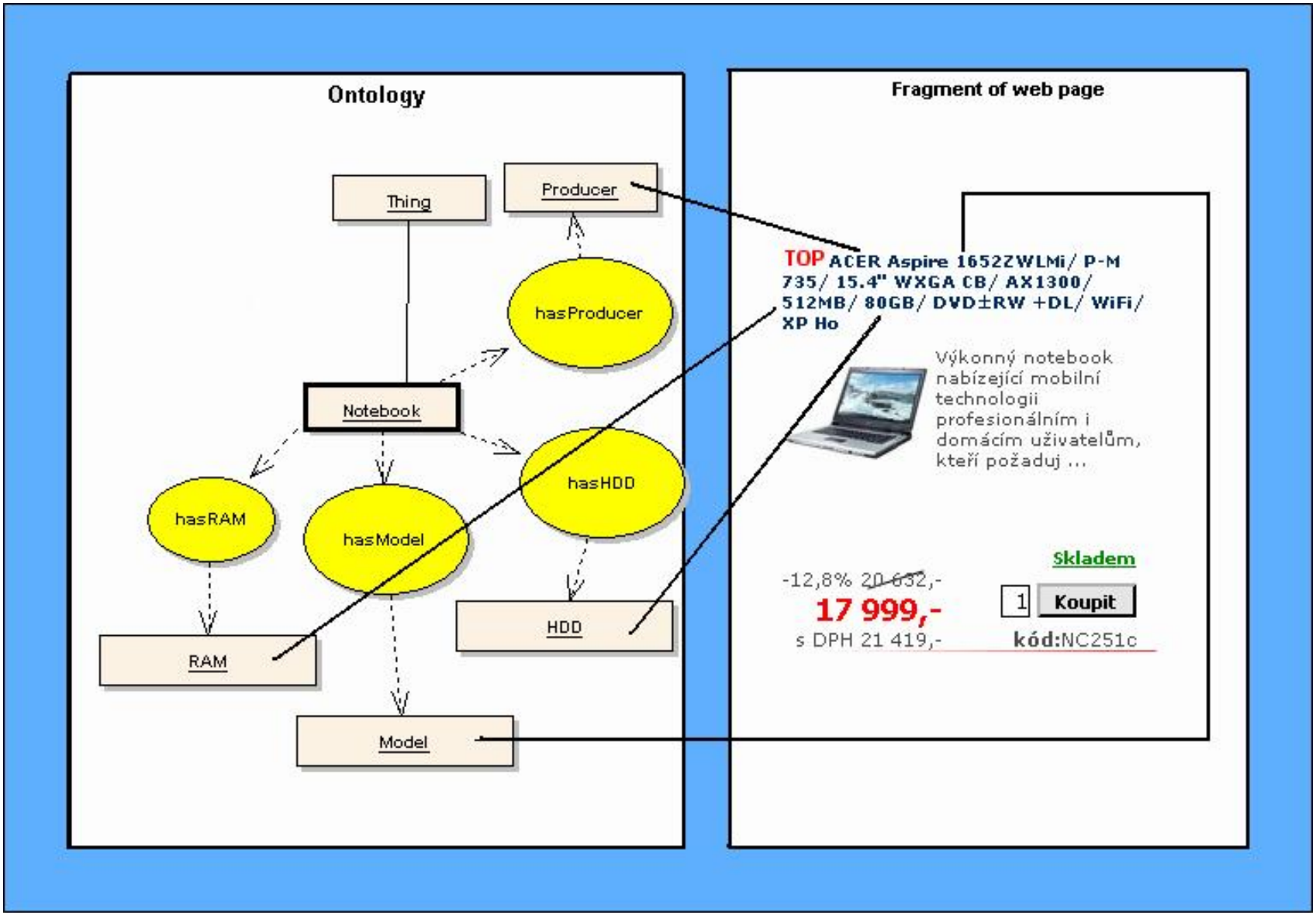
Chia-Hui Chang, Mohammed Kayed, Moheb Ramzy Girgis, Khaled F. Shaalan, "**A Survey of Web Information Extraction Systems**," IEEE Transactions on Knowledge and Data Engineering, vol. 18, no. 10, pp. 1411-1428, October, 2006.

User initiative and effort – Web Semantization

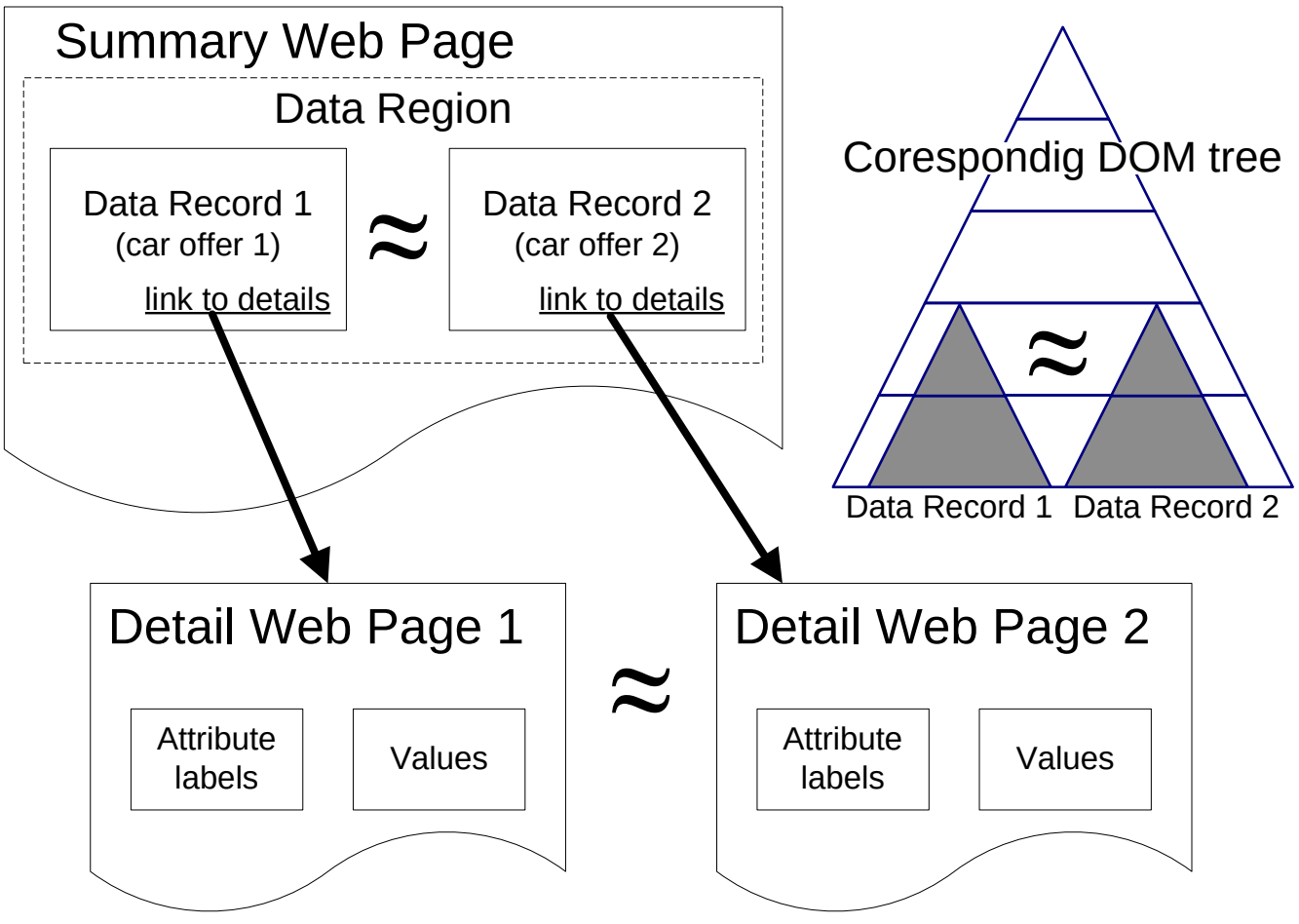


- Not only Information Extraction
- But also Semantic Annotation
- Domain specific knowledge has to be obtained in all cases.
- Scalability?

Extraction Based on Structural Similarity (suitable for Web Shops)



Extraction Based on Structural Similarity – extraction method



Benchmarks for Information Extraction

- No common benchmark for "structured pages" or Web IE.

- Message Understanding Conference (MUC)
- Automatic Content Extraction (ACE) Evaluation
- Text Analysis Conference (TAC)

- Text REtrieval Conference (TREC)
- Document Understanding Conferences (text summarization)

Classical tasks of text preprocessing and linguistic analysis

Text Extraction – e.g from HTML, PDF or DOC,

Tokenization – detection of words, spaces, punctuations, etc.,

Segmentation – sentence and paragraph detection,

POS Tagging – part of speech assignment, often including lemmatization and morphological analysis,

Syntactic Analysis (often called linguistic *parsing*) – assignment of the grammatical structure to given sentence with respect to given linguistic formalism (e.g. formal grammar),

Coreference Resolution (or *anaphora resolution*) – resolving what a pronoun, or a noun phrase refers to. These references often cross boundaries of a single sentence.

Classical domain dependent IE tasks

Named Entity Recognition: This task recognizes and classifies named entities such as persons, locations, time expression, or measuring units.

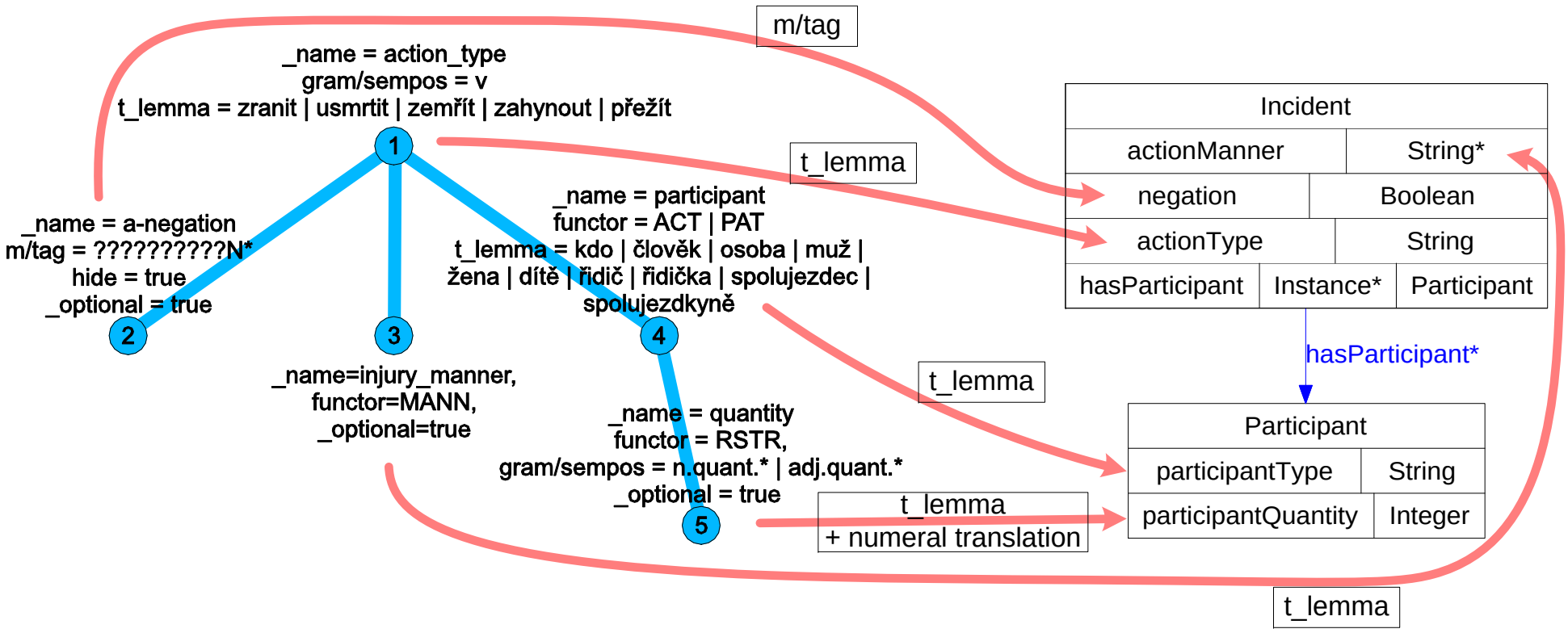
Template Element Construction: Populates templates describing entities with extracted roles (or attributes) about one single entity.

Template Relation Construction: As each template describes information about one single entity, this tasks identifies semantic relations between entities.

Template Unification: Merges multiple elementary templates filled with information about identical entities.

Scenario Template Production: Fits Template Elements and Template Relations into templates describing pre-specified event scenarios (pre-specified "queries on the extracted data").

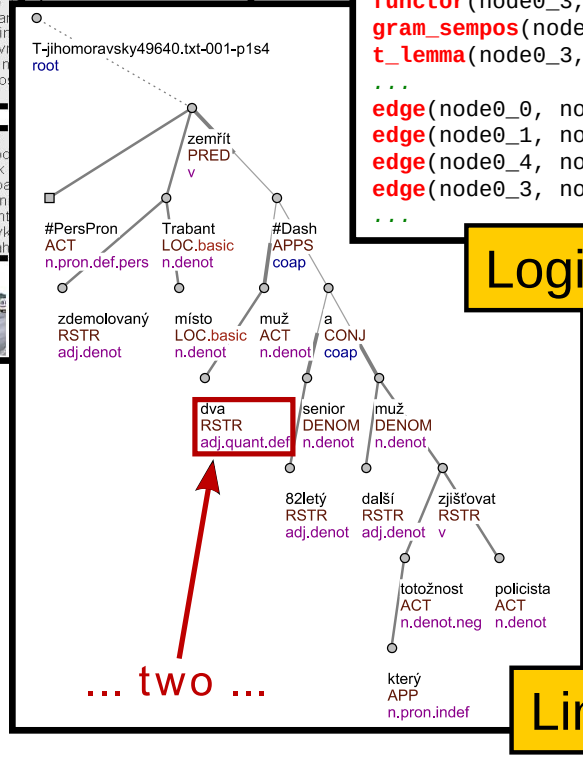
Linguistic IE and Semantic interpretation of extraction rules



- Determines how particular values of attributes are used.
- Gives semantics to extraction rule.
- Gives semantics to extracted data.

Linguistic IE – ILP Learning of Extraction Rules

Source web page



Linguistic trees

```
tree_root(node0_0). node(node0_0).
id(node0_0, t_jihomoravsky49640_txt_001_p1s4).
%%%%%%%% node0_1 %%%%%%%%%%%%%%%%%%
node(node0_1).
functor(node0_1, pred).
gram_sempos(node0_1, v).
t_lemma(node0_1, zemrit).
%%%%%%%% node0_2 %%%%%%%%%%%%%%%%%%
node(node0_2).
functor(node0_2, act).
gram_sempos(node0_2, n_pron_def_pers).
t_lemma(node0_2, x_perspron).
%%%%%%%% node0_3 %%%%%%%%%%%%%%%%%%
node(node0_3). id(node0_3,
functor(node0_3, loc).
gram_sempos(node0_3, n_denot).
t_lemma(node0_3, trabant).
...
edge(node0_0, node0_1). edge(node0_1, node0_2).
edge(node0_1, node0_3). edge(node0_3, node0_4).
edge(node0_4, node0_5). edge(node0_3, node0_6).
edge(node0_3, node0_7). edge(node0_3, node0_8).
...
```

Logic representation

Conclusion and Future Work

Conclusion:

- Partial survey of WIE systems (see the paper for references)
  - Related to Web Semantization
- Problem of unskilled user pointed out

Future Work:

- Future development of WIE tools and work on their adaptability to new domains.
- Integration of WIE tools to the web semantization system.
- Development of the methodology and software to support the extension of the semantization system to a new domain for a non-expert user.