Understanding the Hidden Web

Pierre Senellart

17 June 2005

The Hidden Web

Definition (Hidden Web)

The set of webpages (which may or may not be dynamically generated) not accessible from the hyperlinked structure of the World Wide Web.

Size estimate (2001) : 500 times larger than the surface Web.

How to understand it and benefit from its content?

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- Intensional indexing of the Hidden Web
- High-level queries
- $\Rightarrow$ a semantic search engine over the Hidden Web

In a fully, unsupervized, way!

Difficult and broad problem. Possible restriction to some domain (e.g. publications).

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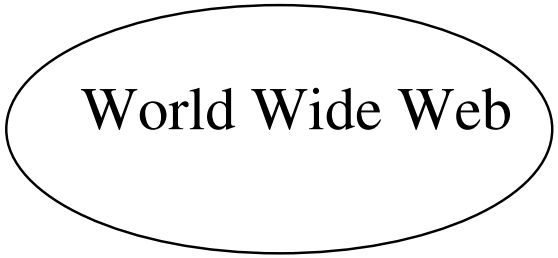

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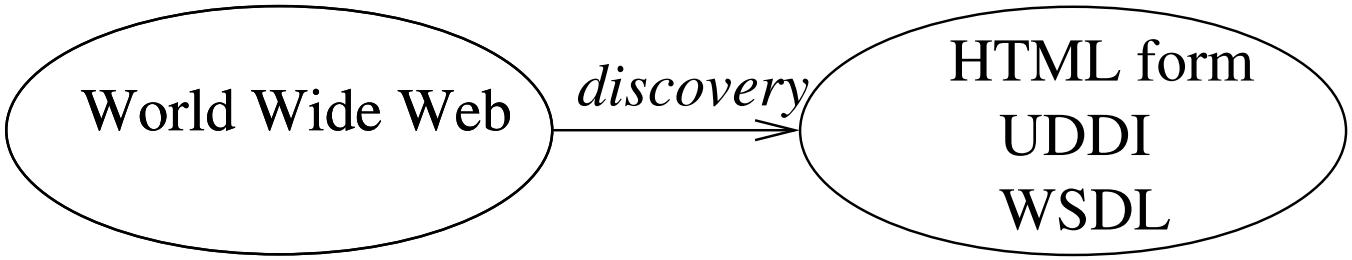

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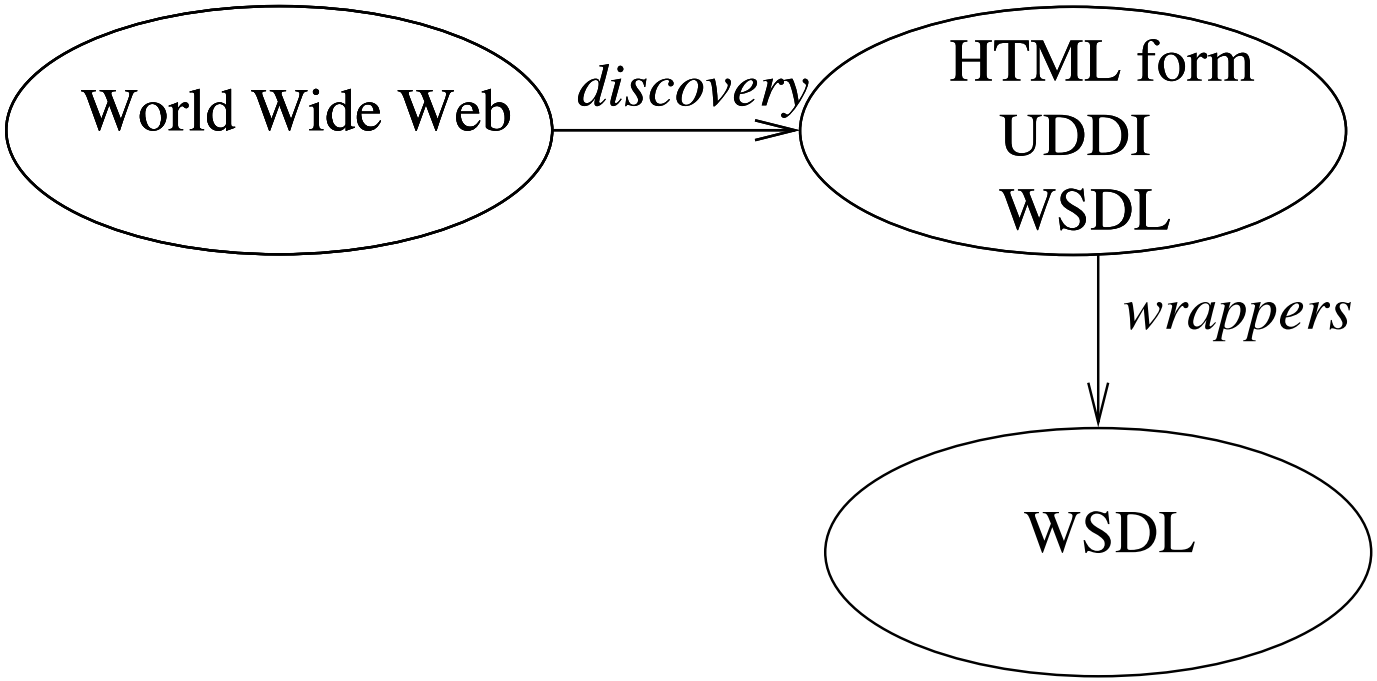

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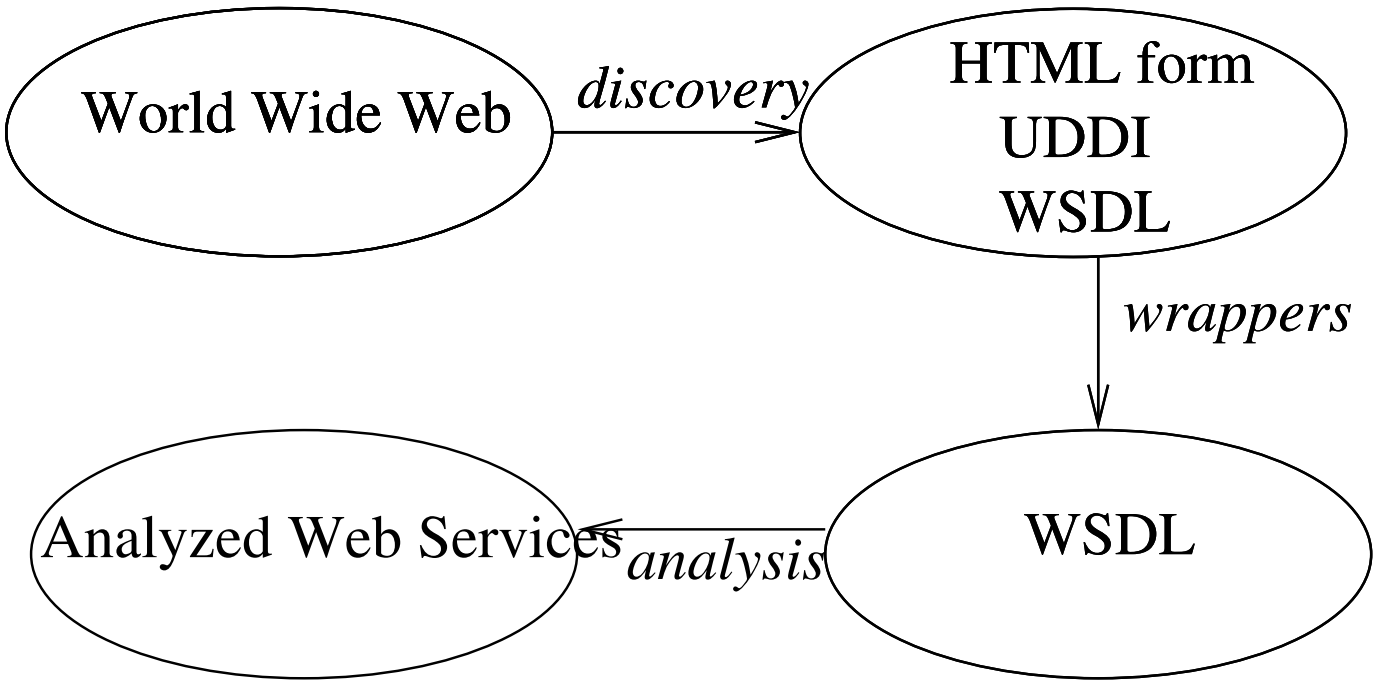

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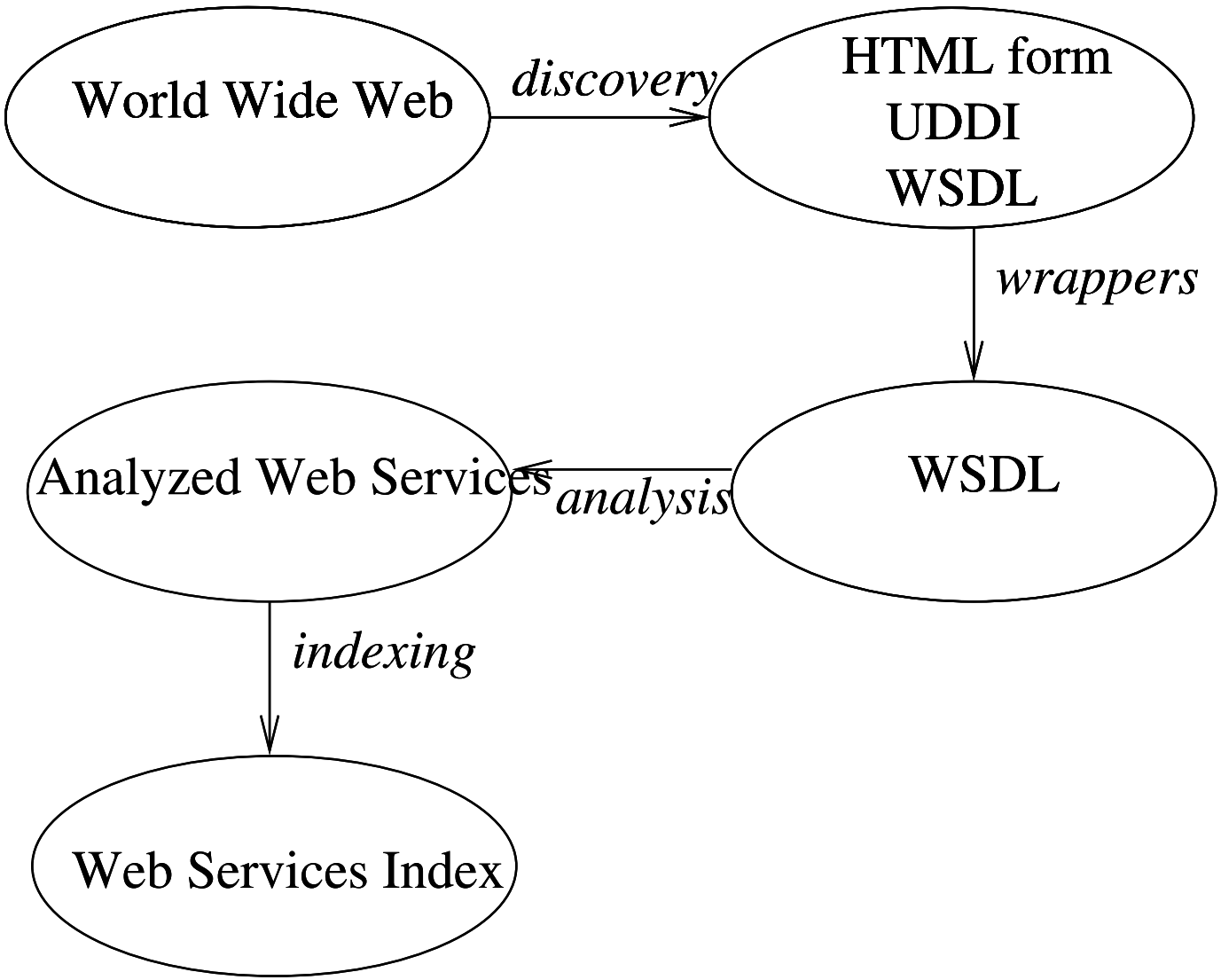

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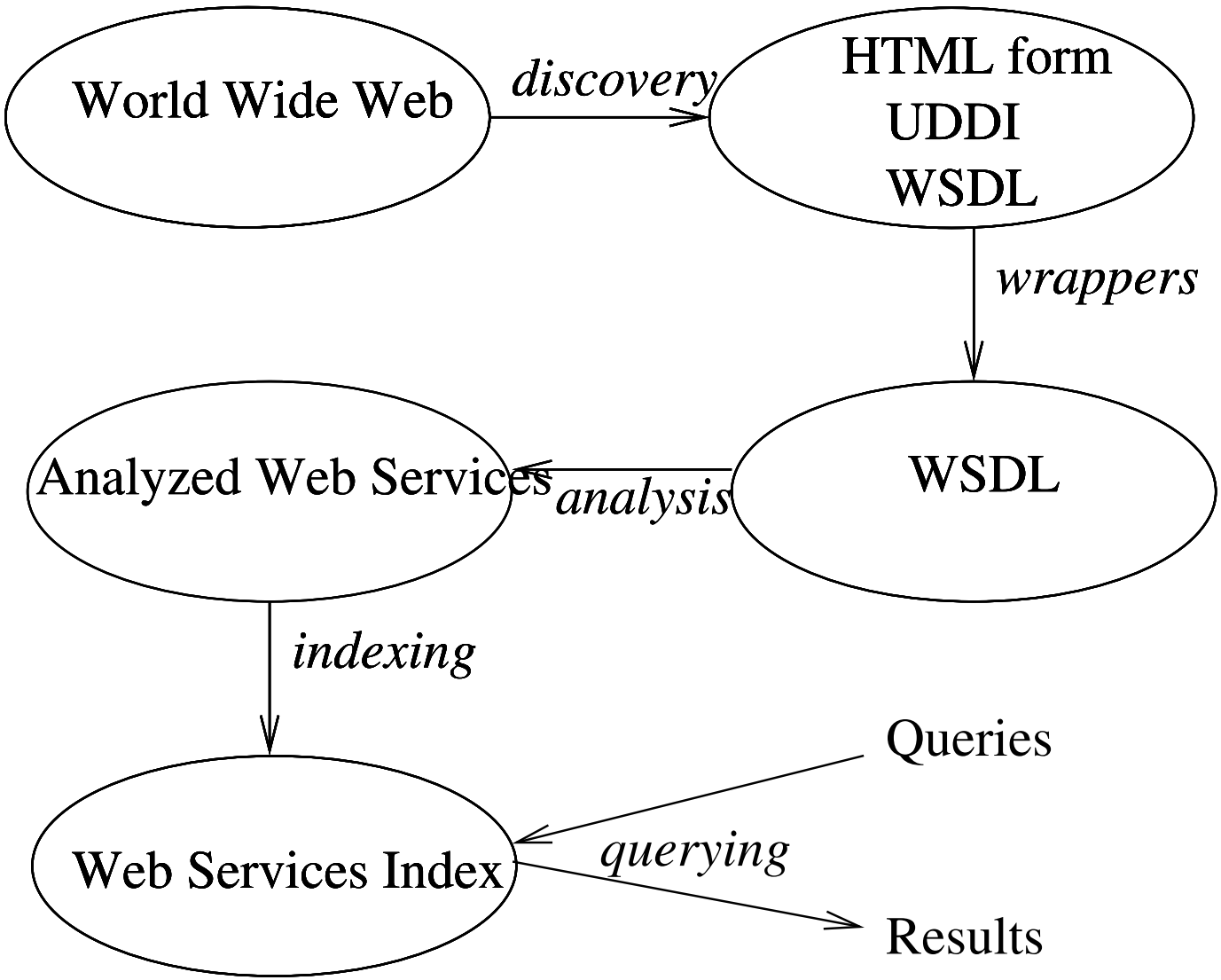

Web Service Discovery

Crawling the World Wide Web for:

- HTML forms implementing a Web Service
- UDDI registries
- WSDL descriptions
- Other resources (XML, HTML, Web as a full-text index…)

Only interested in Web Services with no side effects:

Ok	Not Ok
Yellow Pages	Booking services
Publication databases	Mailing list management
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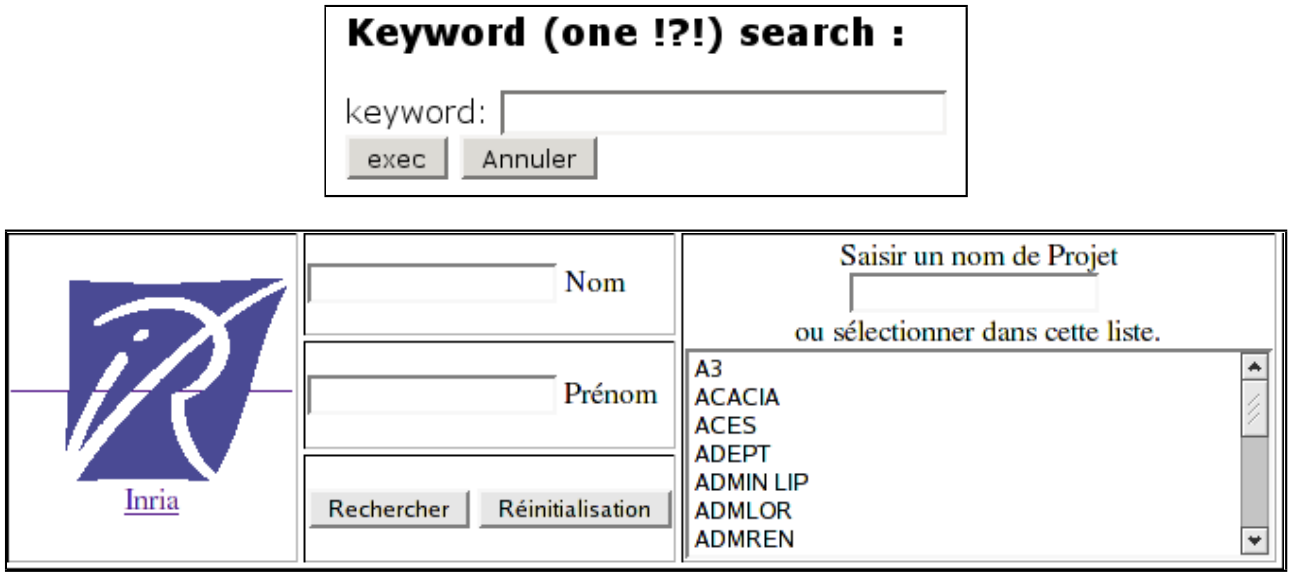
Analyzing the structure of HTML forms.



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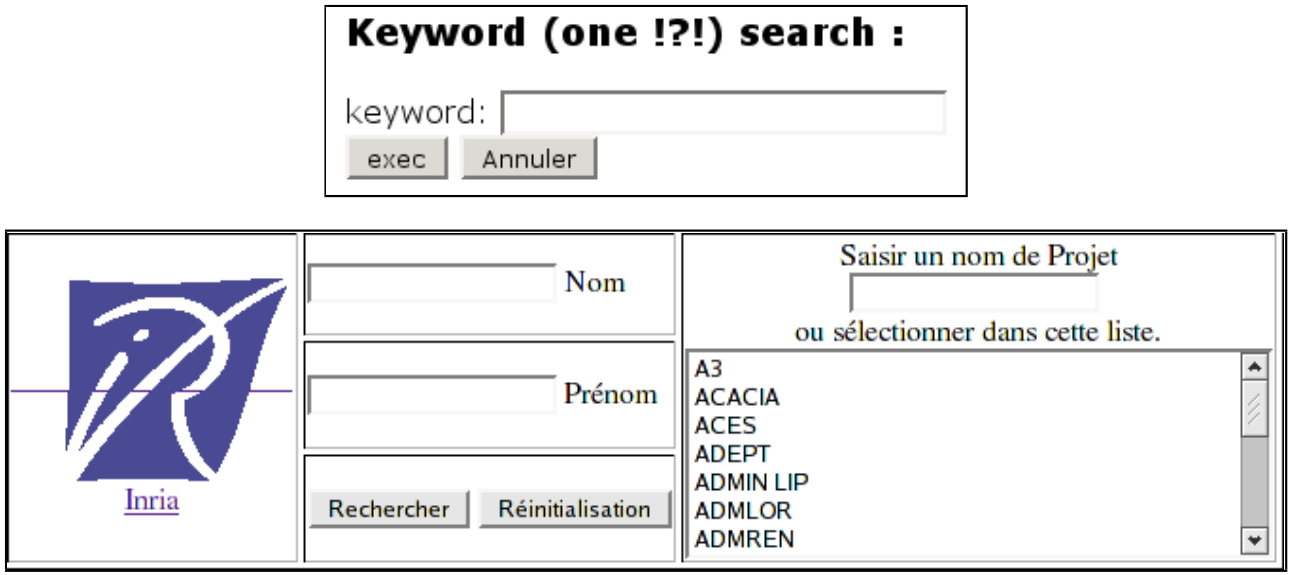

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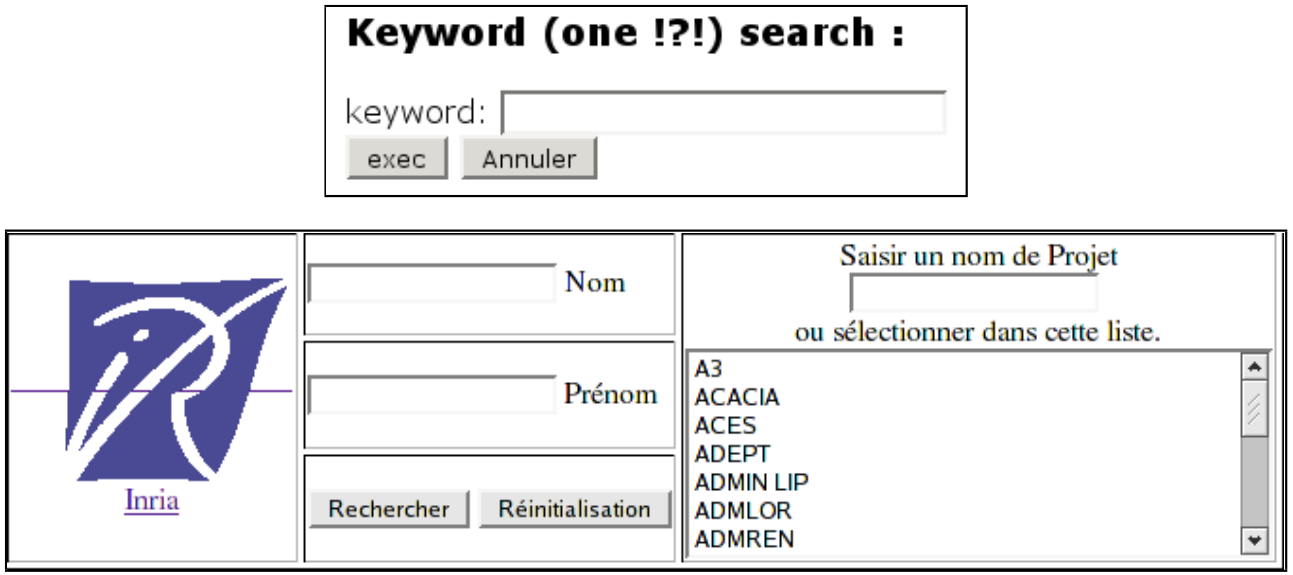

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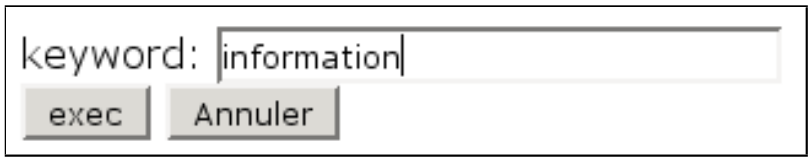
- With dictionary words



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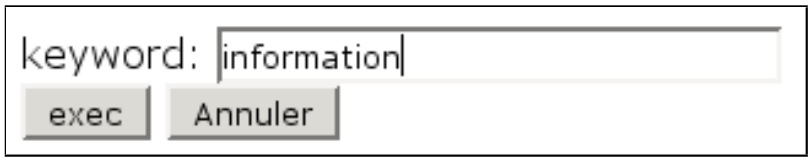

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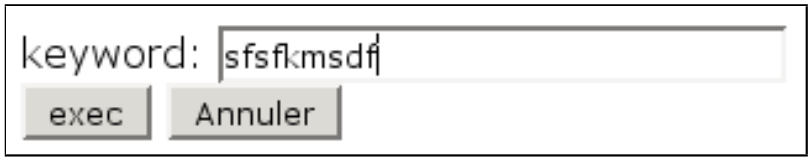

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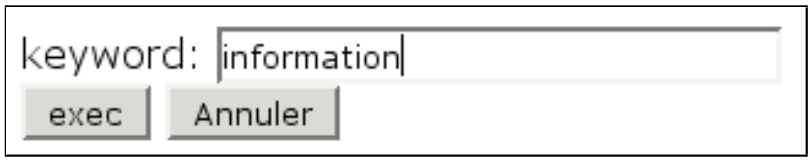

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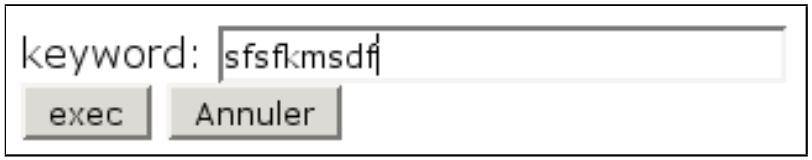

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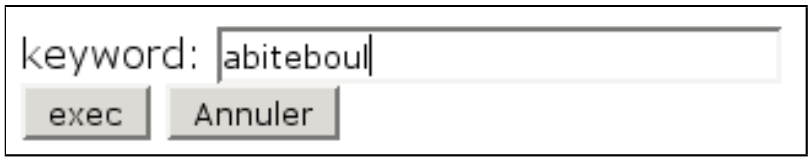

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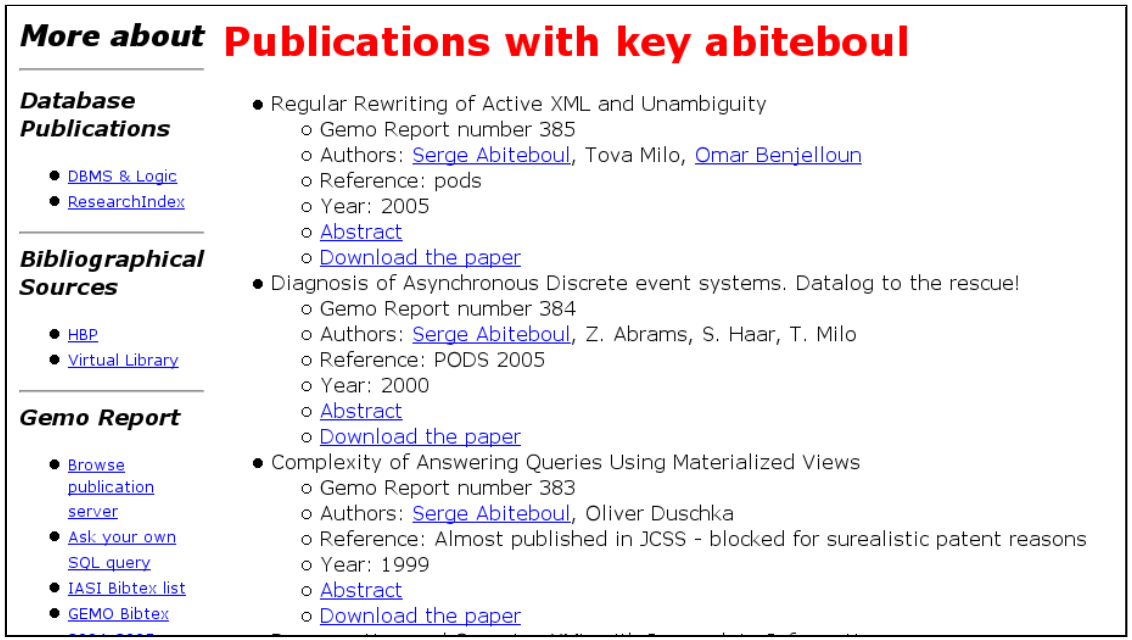
Extract data from query-answer webpages.



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Database Publications

- DBMS & Logic
- ResearchIndex

Bibliographical Sources

- HBP
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Gemo Report

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Publications with key abiteboul

- Regular Rewriting of Active XML and Unambiguity
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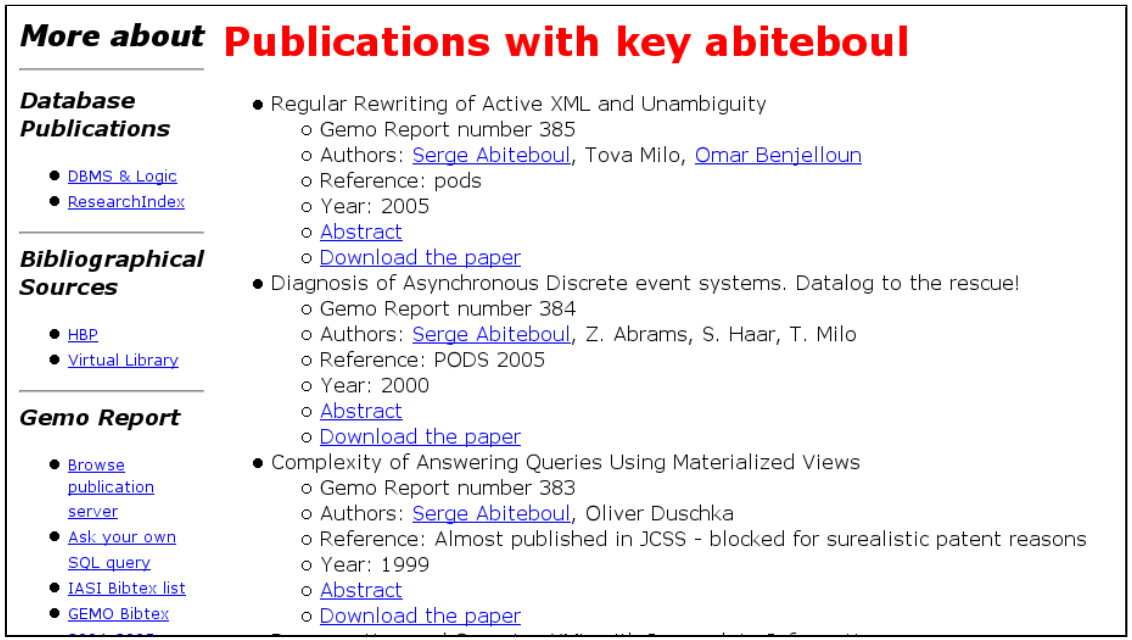

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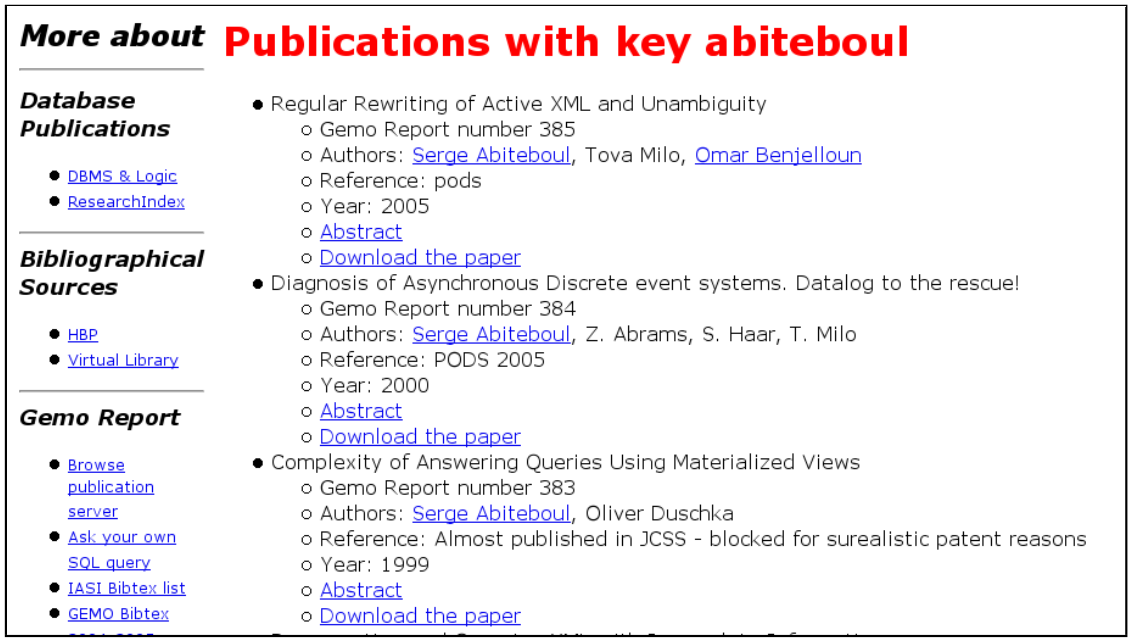

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RoadRunner

Example: RoadRunner information extraction engine

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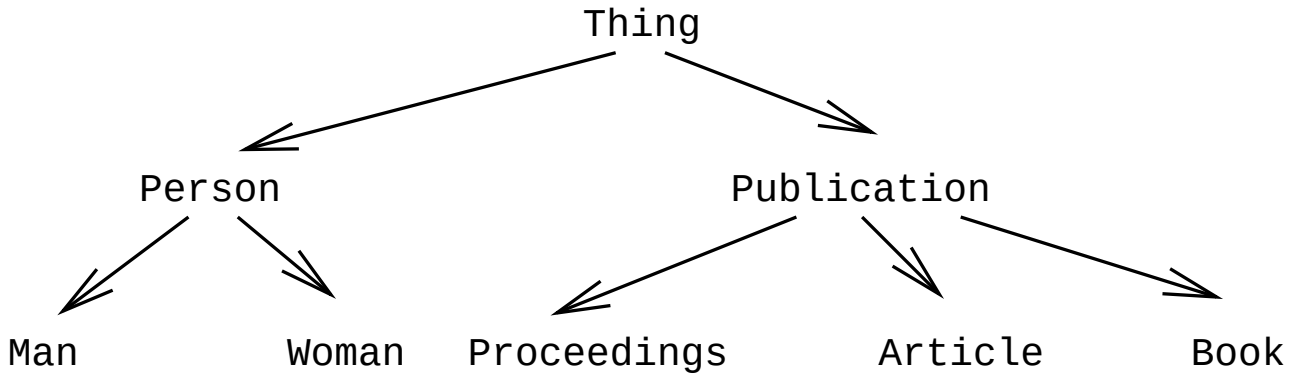
Conceptual Model

- IsA ontology of concepts (simple DAG)



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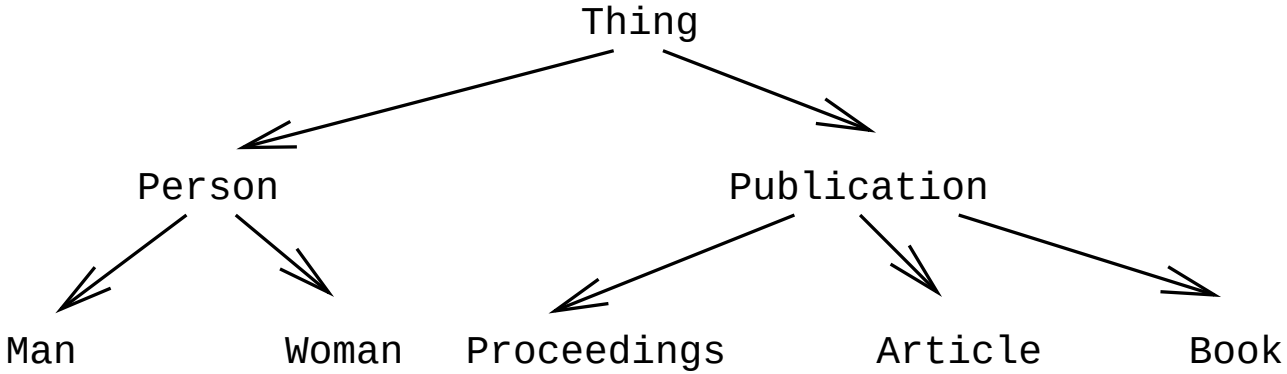

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What is a service described by?

- A *n*-uple of typed input parameters
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- Semantic relations between inputs and outputs

Definition (Complex types)

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Services and queries

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Service giving authors from publication titles

$$A^* \leftarrow \texttt{WrittenBy}(P,A), \texttt{HasTitle}(P,T), \text{Input}(T)$$

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Query:

$$\langle A, T^* \rangle^* \leftarrow \texttt{WrittenBy}(P,A), \texttt{Article}(P), \texttt{HasTitle}(P,T), \texttt{KeywordOf}(\text{“xml”}, P)$$

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Managing extensional information

How to represent extensional information (i.e. documents) in this formalism?

Definition

A document is a service with no input.

Complex types: natural representation of a DTD.

(Disjunctions `a|b` simulated by `(a?,b?)`).

Semantic Interpretation of a Service

How to analyze a Web Service?

- Field labels, variable names, tag names
- Concrete type descriptions (e.g. `\d{4}-\d{2}-\d{2}` is a date)
- Linguistic analysis of plain text descriptions and pages linking to the service

Note: Extracting concepts is easier than extracting relations between concepts.

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Three main differences:

- Information can be queried only through *views* (Local As View)
- Nested types
- Incomplete information

Three sources of complexity!

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