A4M36AOS – Architektury orientované na služby

11. Semantic WEB/Services

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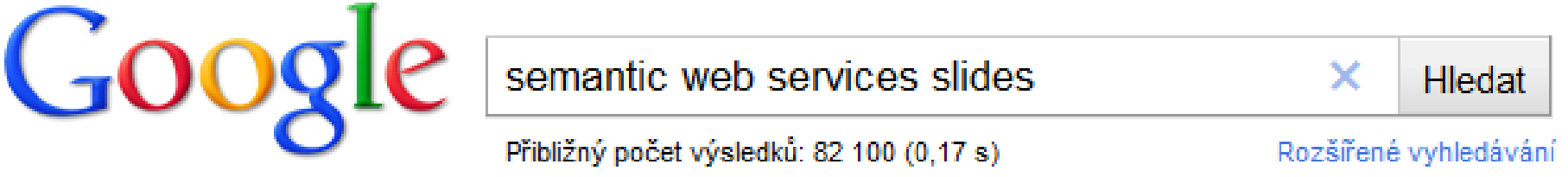
Semantic Services



… in 2010

Semantic Services

Web Services - Semantic Web - Slide list - [Přeložit tuto stránku]
Web Services - Semantic Web by Tim Berners-Lee. Table of contents. **Web Services** and **Semantic Web**: Integrating Applications · To Integrate · **Web Services ...**
www.w3.org/2003/Talks/0521-www-keynote-tbl/ - Archiv - Podobné

[PDF]
Rules + Ontologies for **Semantic Web Services** - [Přeložit tuto stránku]
Formát souboru: PDF/Adobe Acrobat - Rychlé zobrazení
napsal/a B Grosof - Počet citací tohoto článku: 4 - Související články
6 Dec 2002 **...** for **Semantic Web Services**. **Slides** presented at U. Maryland Computer Science Dept. Seminar, 12/06/2002. Hosted by Jim Hendler **...**
ebusiness.mit.edu/bgrosof/paps/talk-sws-rules+ont-12-02.pdf

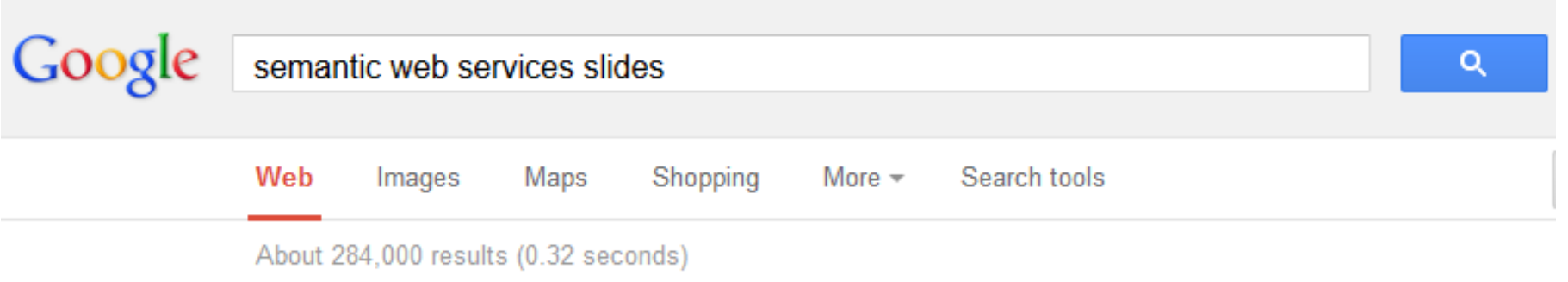
STI Education » 1st **Semantic Web Services** Winter Retreat
- [Přeložit tuto stránku]
The Semantics of 'B' in 'BPM — Business Process Management' (**slides**) Patrick Maué (University of Münster, DE): **Web Services** in the Geospatial **Semantic Web ...**
education.sti2.org/events/sws-retreat-09/ - Archiv - Podobné

Enhancing **Semantic Web Services** with Inheritance
- [Přeložit tuto stránku]
24 Nov 2008 **... Slides**. 0:00, Enhancing **Semantic Web Services** with Inheritance. 0:59, Outline. 1:54, Outline (1). 1:57, Motivation **...**
videolectures.net/iswc08_feng_eswsi/ - Archiv

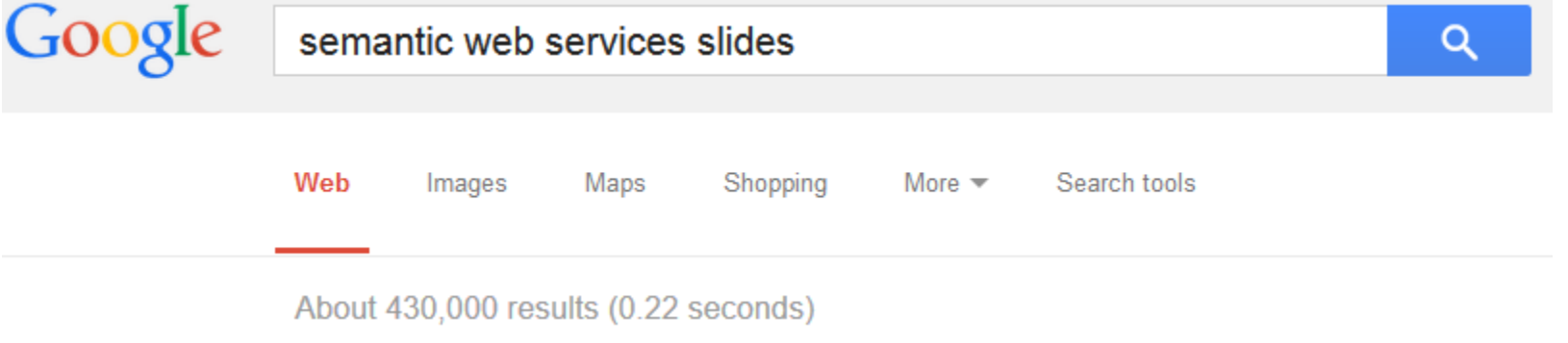
DIP - Data, Information and Process Integration with **Semantic Web ...**
- [Přeložit tuto stránku]
Introduces the concept of **Semantic Web Services**; 40 participants; Special regard to integration with Agent Technology; **Slide** set: PDF **...**
kmi.open.ac.uk/projects/dip/events.html - Archiv

[PPT] **Semantic Web** Tutorial by John Davies - [Přeložit tuto stránku]
Formát souboru: Microsoft Powerpoint - Zobrazit jako HTML
Knowledge Management; **Web Services**. **Slide**. History of the **Semantic Web ..... Slide**. Future **Web Services** - exploiting the **Semantic Web ...**
www.keapro.net/sekt/Sem**Web**TutorialGeneralJD.ppt - Podobné

Semantic Services

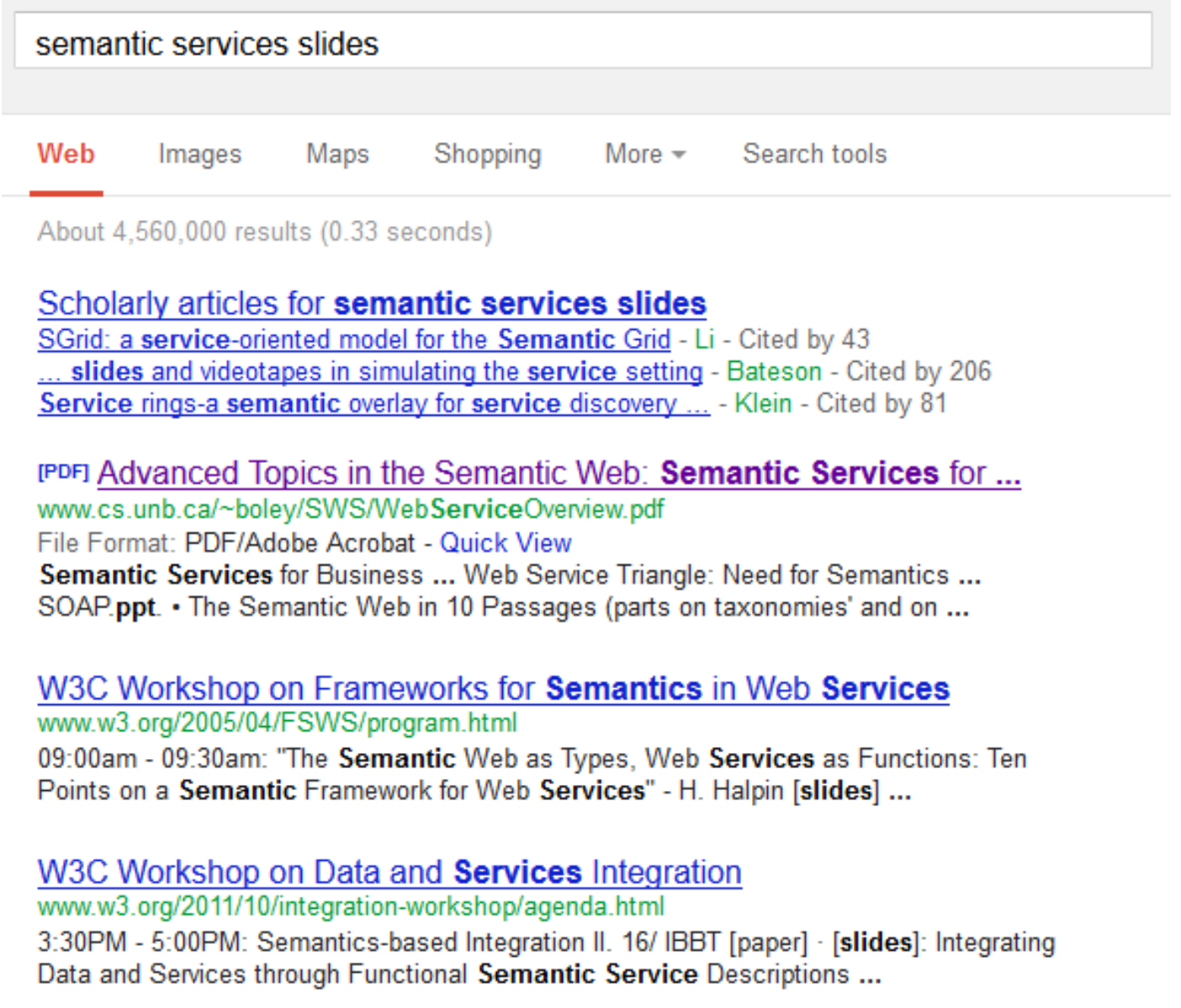


… in 2012

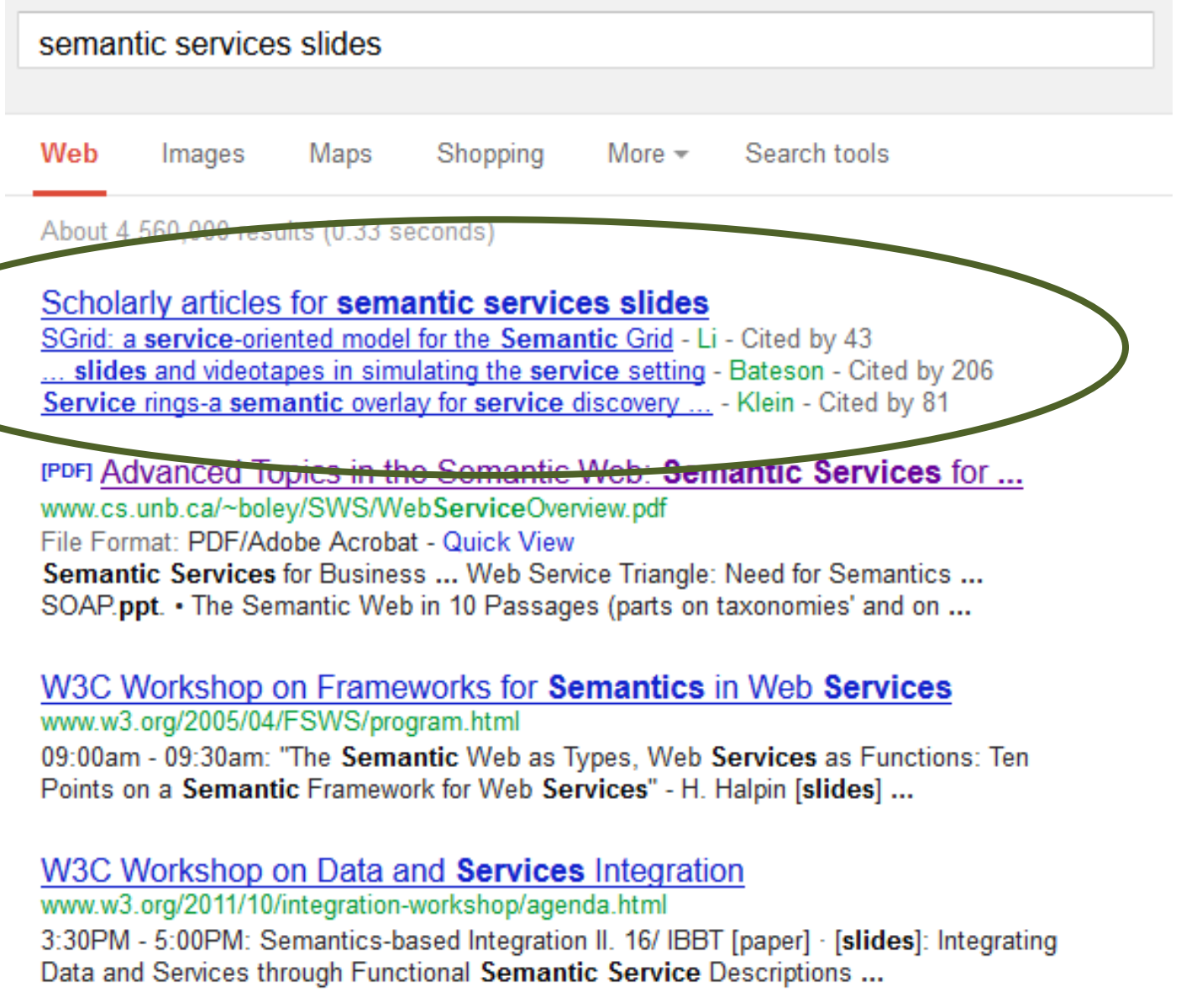


… in 2013

Semantic Services



Semantic Services



Semantic Services

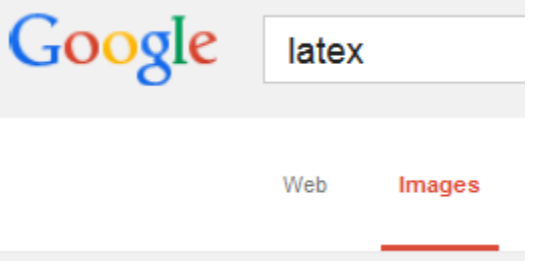
- Problem of the web/internet
  - Find relevant information
  - Extract relevant information
  - Combine and reuse (consume) the information

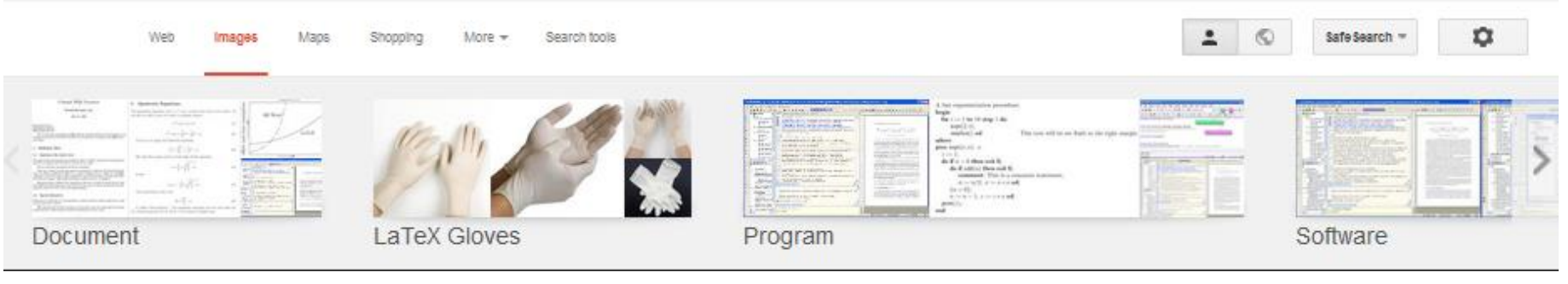
Semantic Services

- Finding the information in natural language is a problem
- Example: **homonyms**
- Example: **synonyms**

Semantic Services

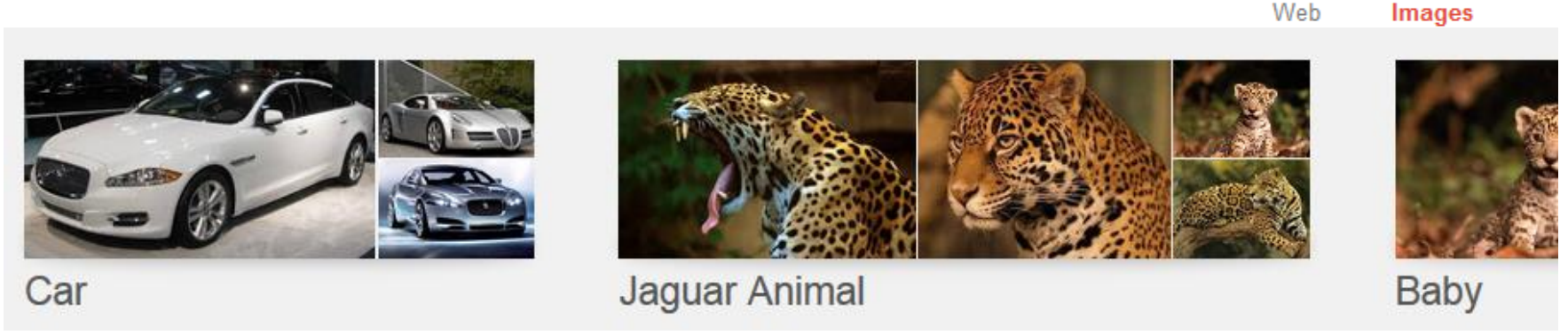
- Finding the information in natural language is a problem
- Example: **homonyms**





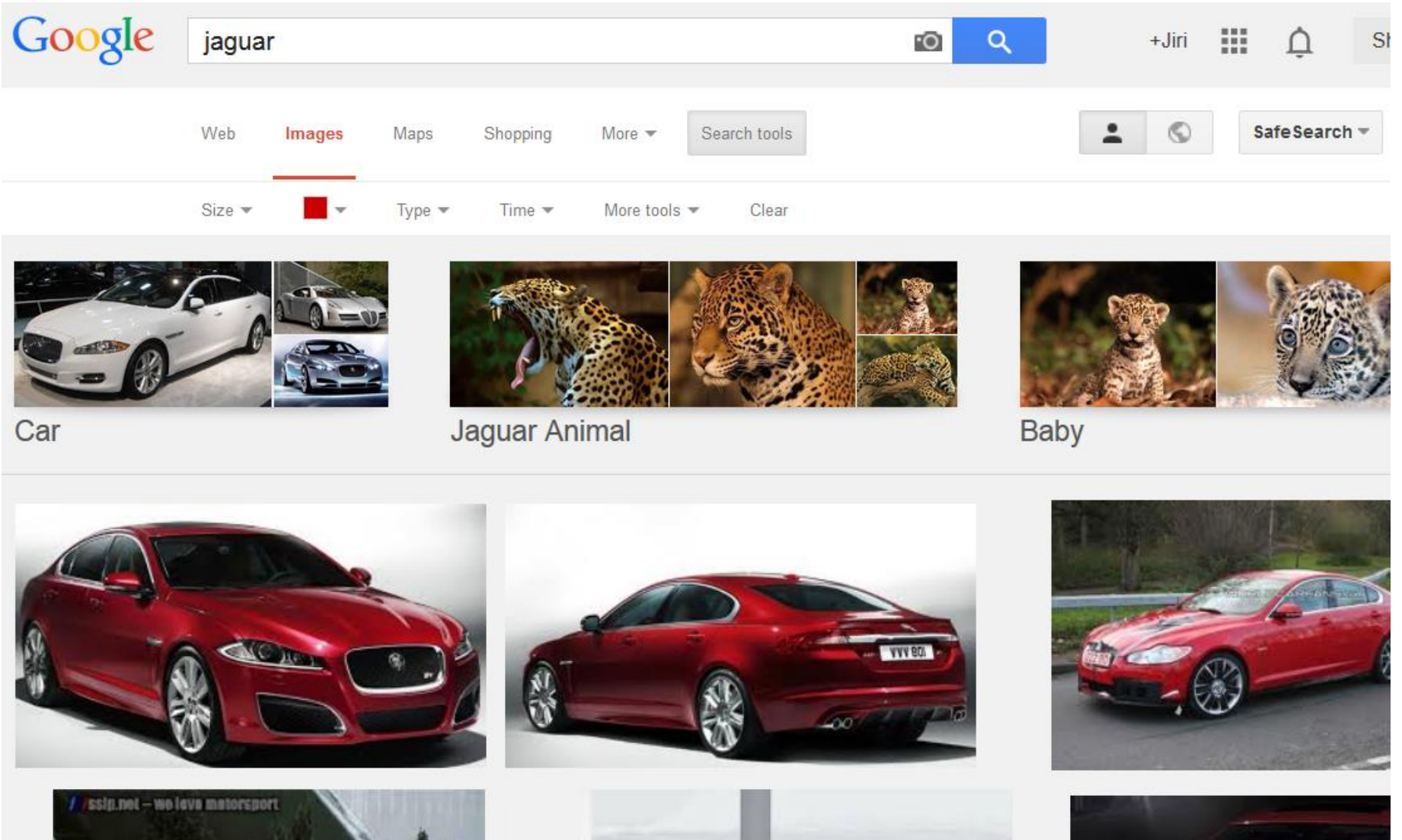
Semantic Services

- Finding the information in natural language is a problem
- Example: **homonyms**



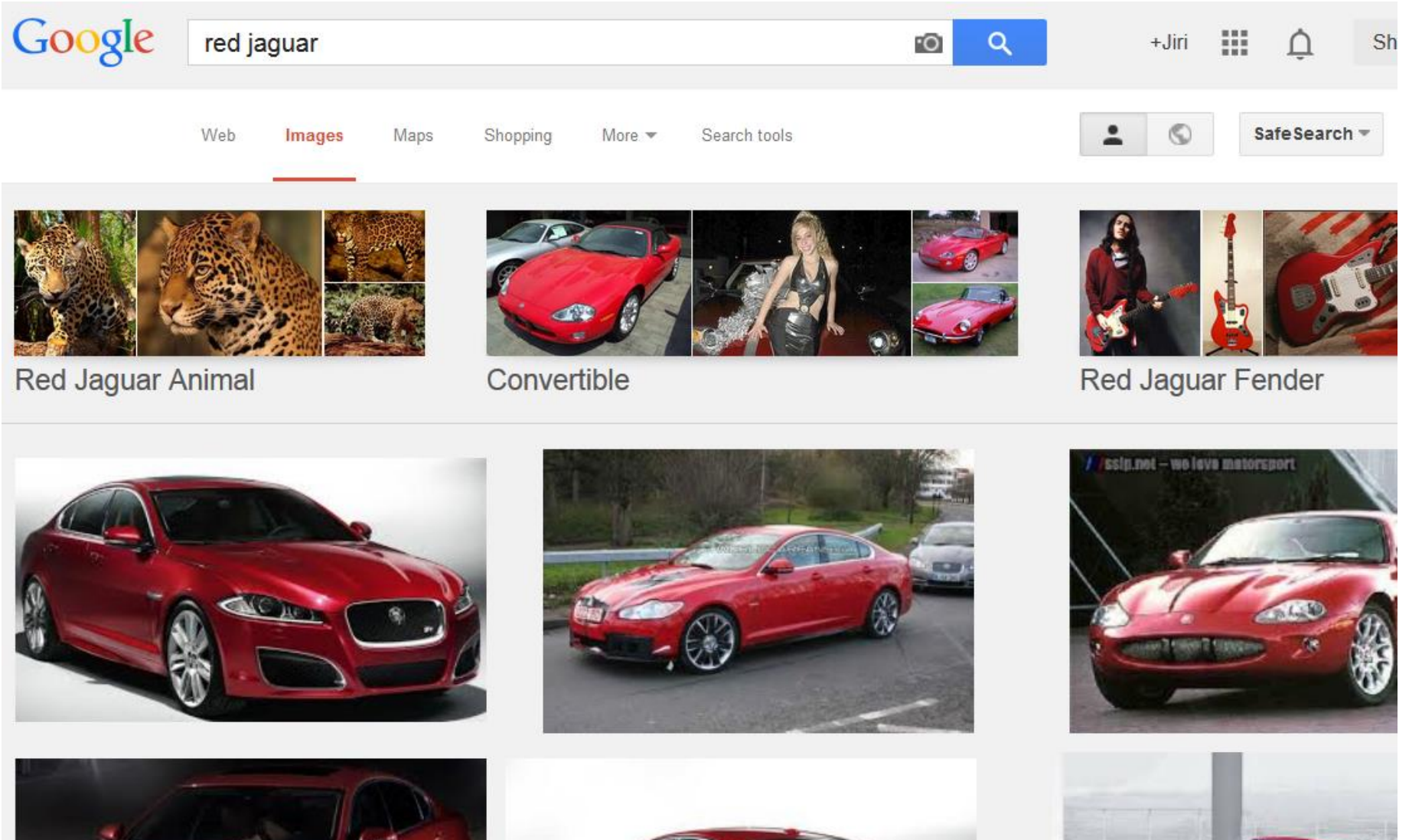
Semantic Services

- Red Jaguar vs. Jaguar (red color filter)



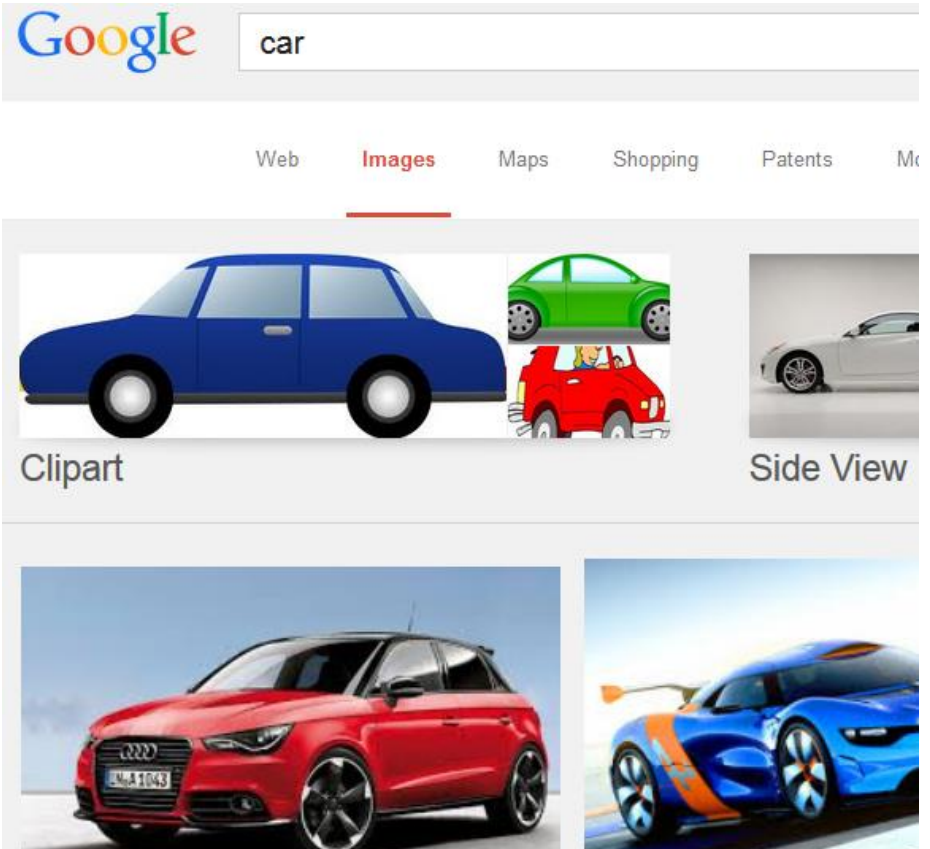
Semantic Services

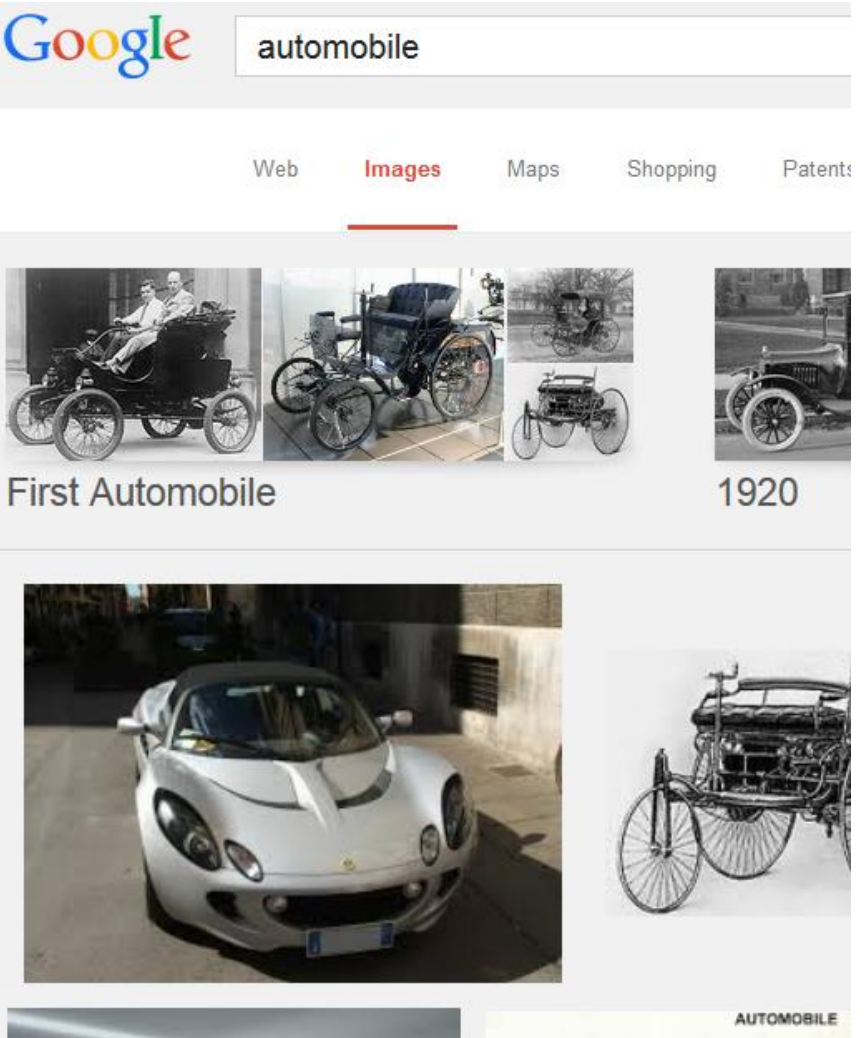
- Red Jaguar vs. Jaguar (red color filter)



Semantic Services

- Finding the information in natural language is a problem
- Example: **synonyms**





Semantic Services

- Other problems
  - Spelling and language variants
  - Multiple similar languages
  - Misspelling and typos
  - Unclear data interpretation
  - Too general keywords vs. too restrictive phrases, background knowledge needed

Semantic Services

- Find information about "animals that use sonar but are not either bats, dolphins or whales"
- Locating information in data repositories
- Travel enquiries
- Prices of goods and services
- Delegating complex tasks to web "agents"

  "Book me a holiday next weekend somewhere warm, not too far away, and where they speak French or English"

Semantic Services

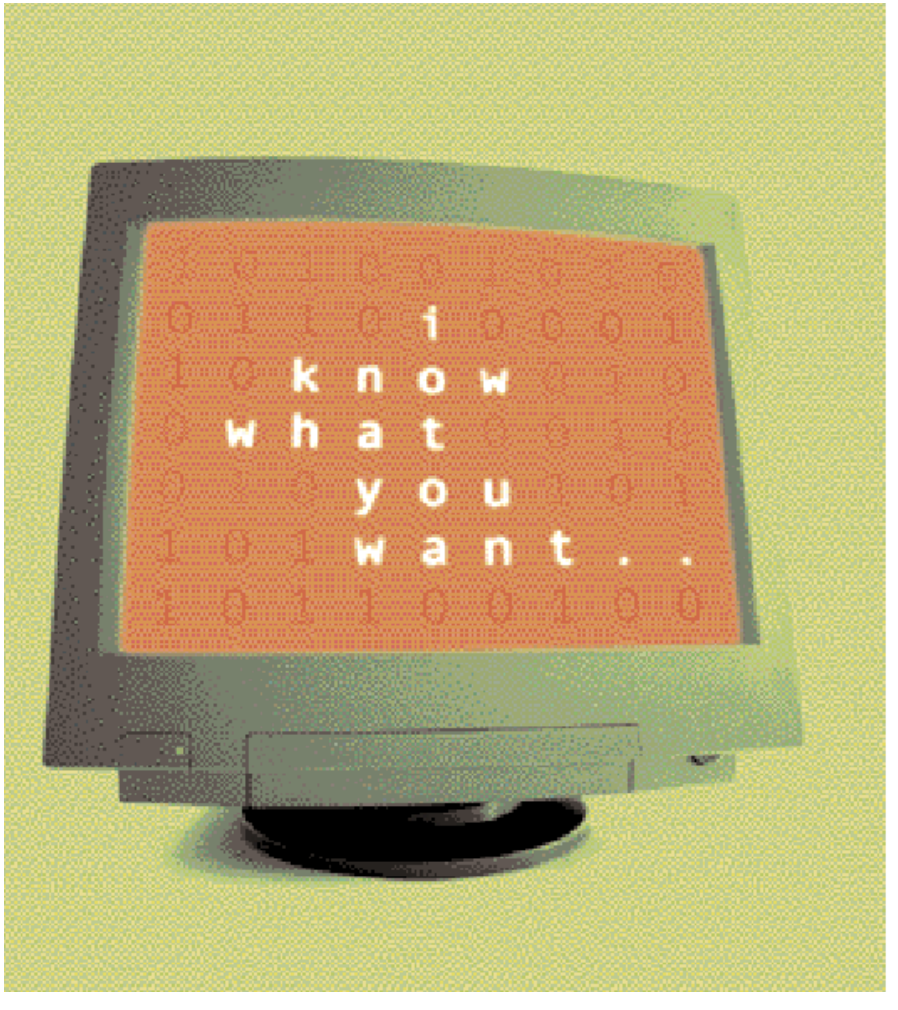
- Extraction of the information – strongly typed services, well defined interface
- Syntax is good, but what about semantics?

Semantic Services

- Extraction of the information – strongly typed services, well defined interface
- Syntax is good, but what about semantics?
- The original vision of the Web:

> "... a goal of the Web was that, if the interaction between person and hypertext could be so intuitive that the **machine-readable** information space gave an accurate representation of the state of people's thoughts, interactions, and work patterns, then **machine analysis** could become a very powerful management tool, seeing patterns in our work and facilitating our working together through the typical problems which beset the management of large organizations."

Semantic Services



THE SEMANTIC WEB

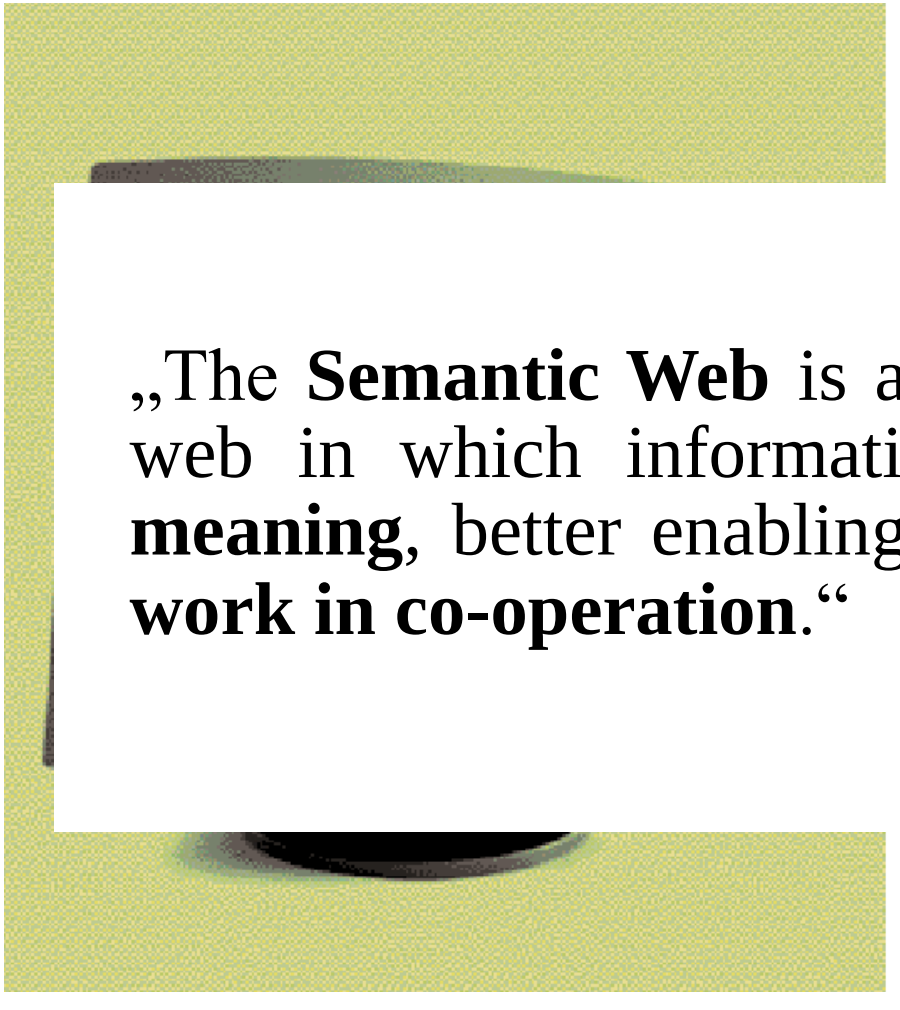
A new form of Web content
that is meaningful to computers
will unleash a revolution of new abilities

by
TIM BERNERS-LEE,
JAMES HENDLER and
ORA LASSILA

PHOTO CREDIT HERE

Scientific American, May 2001

Semantic Services



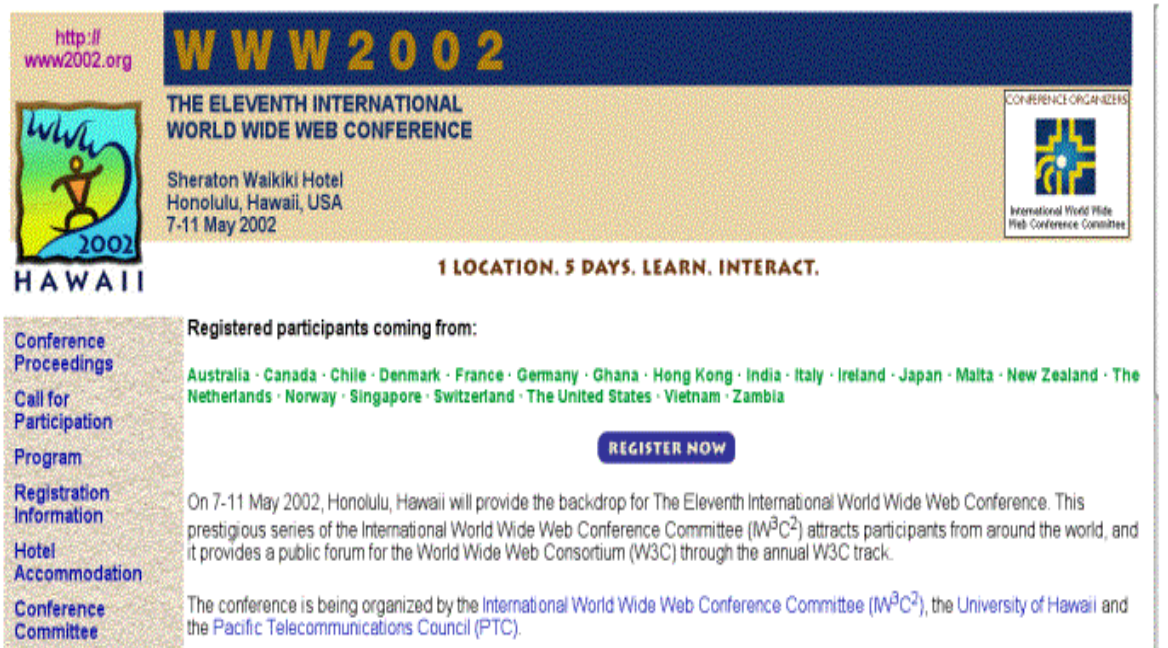
„The **Semantic Web** is an extension of the current web in which information is given well-defined **meaning**, better enabling computers and people to **work in co-operation**.“

by
TIM BERNERS-LEE,
JAMES HENDLER and
ORA LASSILA

Scientific American, May 2001

Semantic Services

- Typical Web Page – markup consists of rendering information (e.g., font size and colour), hyper-links to related content
- Semantic content is accessible to humans but not (easily) to computers…



Semantic Services

- What human can see

WWW2002

The eleventh international world wide web conference

Sheraton waikiki hotel, Honolulu, hawaii, USA

7-11 may 2002, 1 location 5 days learn interact

Registered participants coming from

australia, canada, chile denmark, france, germany, ghana, hong kong,, norway, singapore, switzerland, the united kingdom, the united states, vietnam, zaire

Register now

On the 7th May Honolulu will provide the backdrop of the eleventh international world wide web conference. This prestigious event..

Speakers confirmed

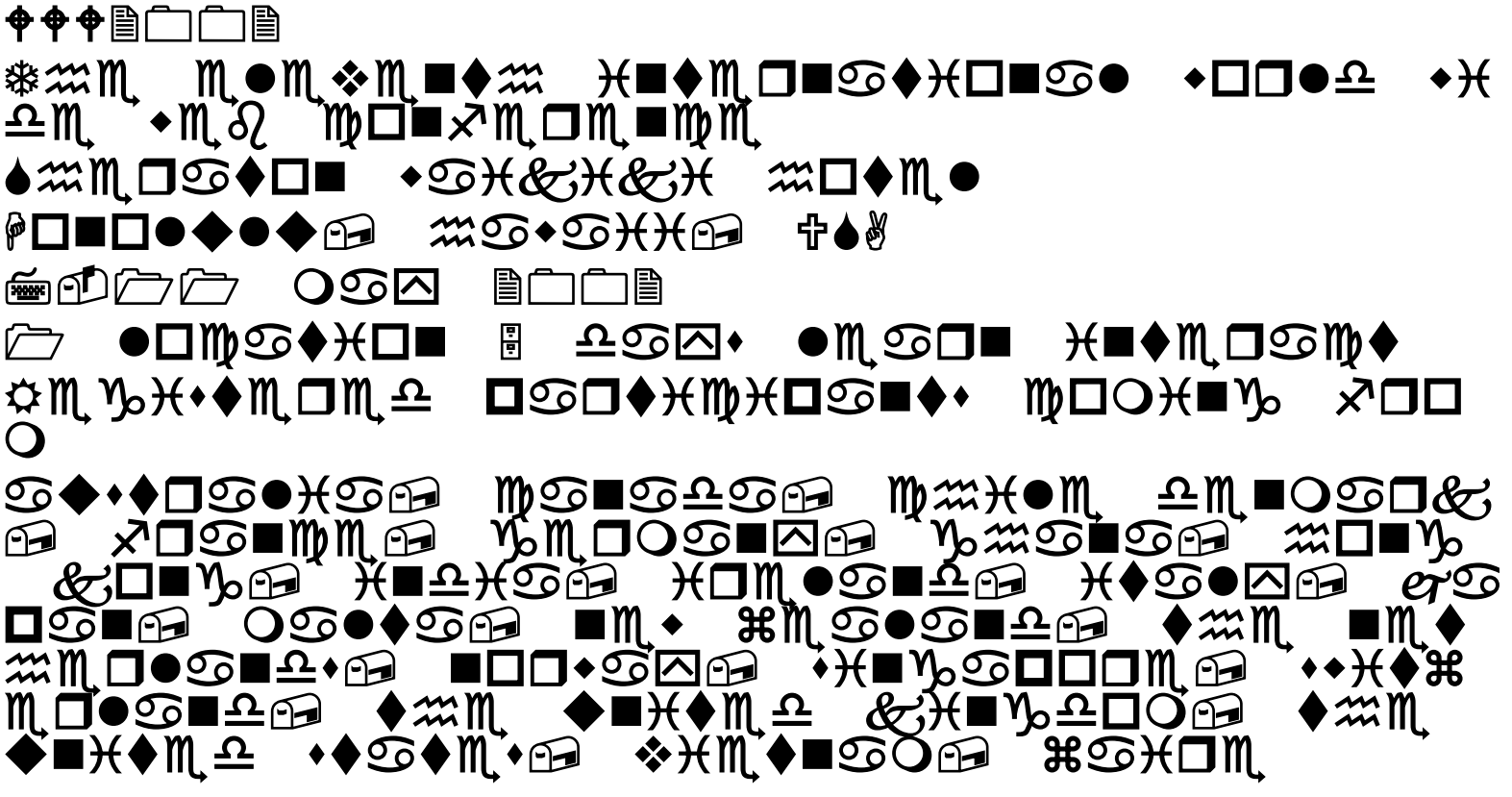
Tim berners-lee

Tim is the well known inventor of the Web, …

Ian Foster

Semantic Services

- What computer can see



Semantic Services

- XML – a solution?

HTML:

```
<H1>Knowledge Management</H1>
   <UL>
      <LI>Manager: John Davies
      <LI>Project: SEKT </UL>
```

XML:

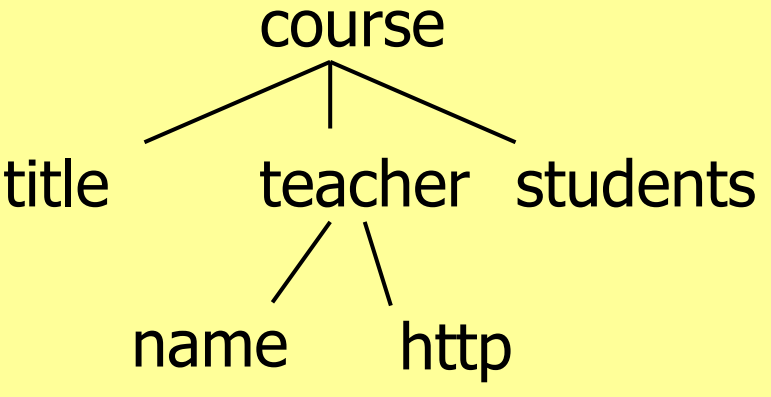
```
<research-topic>
   <title>Knowledge Management</title>
   <manager>John Davies</manager>
   <project>SEKT</project>
</research-topic>
```

Semantic Services

- Node = label + contents
- Forms trees

```
<course date="...">
   <title>...</title>
   <teacher>...</teacher>
      <name>...</name>
      <http>...</http>
   <students>...</students>
</course>
```

=



Semantic Services

- What computer can see?

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Semantic Services

- What computer can see?

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<date>🖮🖆🗁🗁 ○♋🖂 🗎🗀🗀🗎</date>

<strapline>🗁 ●□♍♋♦♓□■ 🗄 ♎♋🖂⬩ ●♏♋□■ ♓■♦♏❒♋
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<participants>☼♏♑♓⬩♦♏❒♏♎ □♋□♦♓♍♓□♋■♦⬩ ♍□○♓■♑
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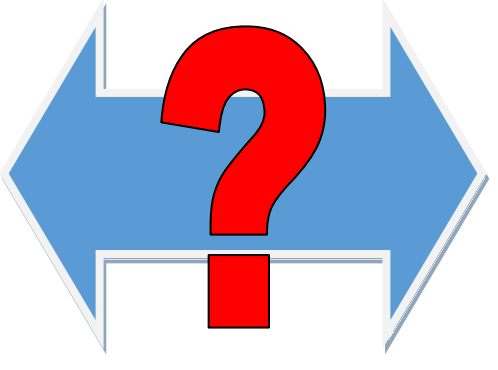
Semantic Services

- What computer can see?

Semantic Services

name		conf
location		place
date		date
slogan		strapline
participants		participants

Semantic Services

- Where to get semantics?
  - External agreement on meaning of annotations
  - Metadata standards - e.g. Dublin Core
  - Agree on the meaning of a set of annotation tags
- Problems with this approach – inflexible, limited number of things can be expressed

Semantic Services

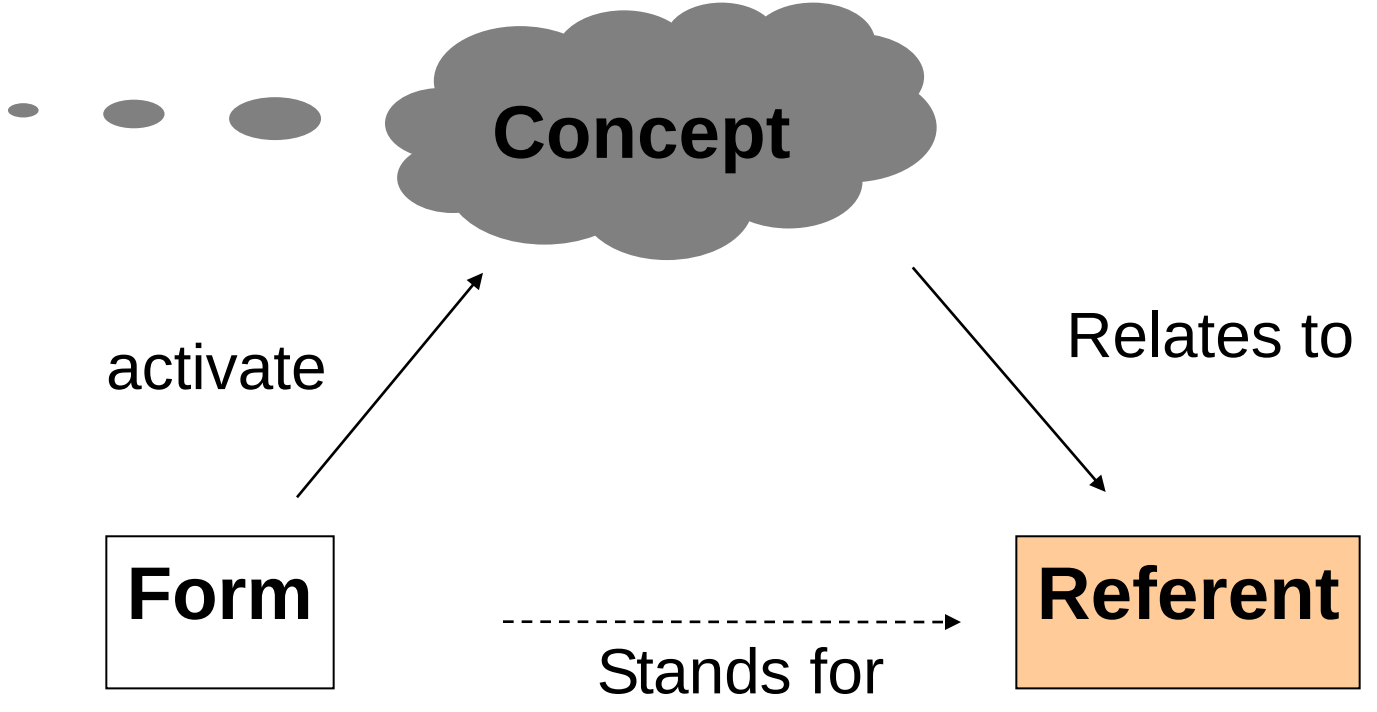
- **Ontologies** to specify meaning of annotations
- Provide a vocabulary of terms
- New terms can be formed by combining existing ones
- Meaning (semantics) of such terms is formally specified
- Can also specify relationships between terms in multiple ontologies

Semantic Services

- Ontology is philosophical discipline – deals with the *nature and the organization* of reality
- Science of Being (Aristotle, Metaphysics, IV, 1)
  - *What characterizes being?*
  - *Eventually, what is being?*

Semantic Services

- Linguistics view (Ogden, Richards, 1923)



Semantic Services

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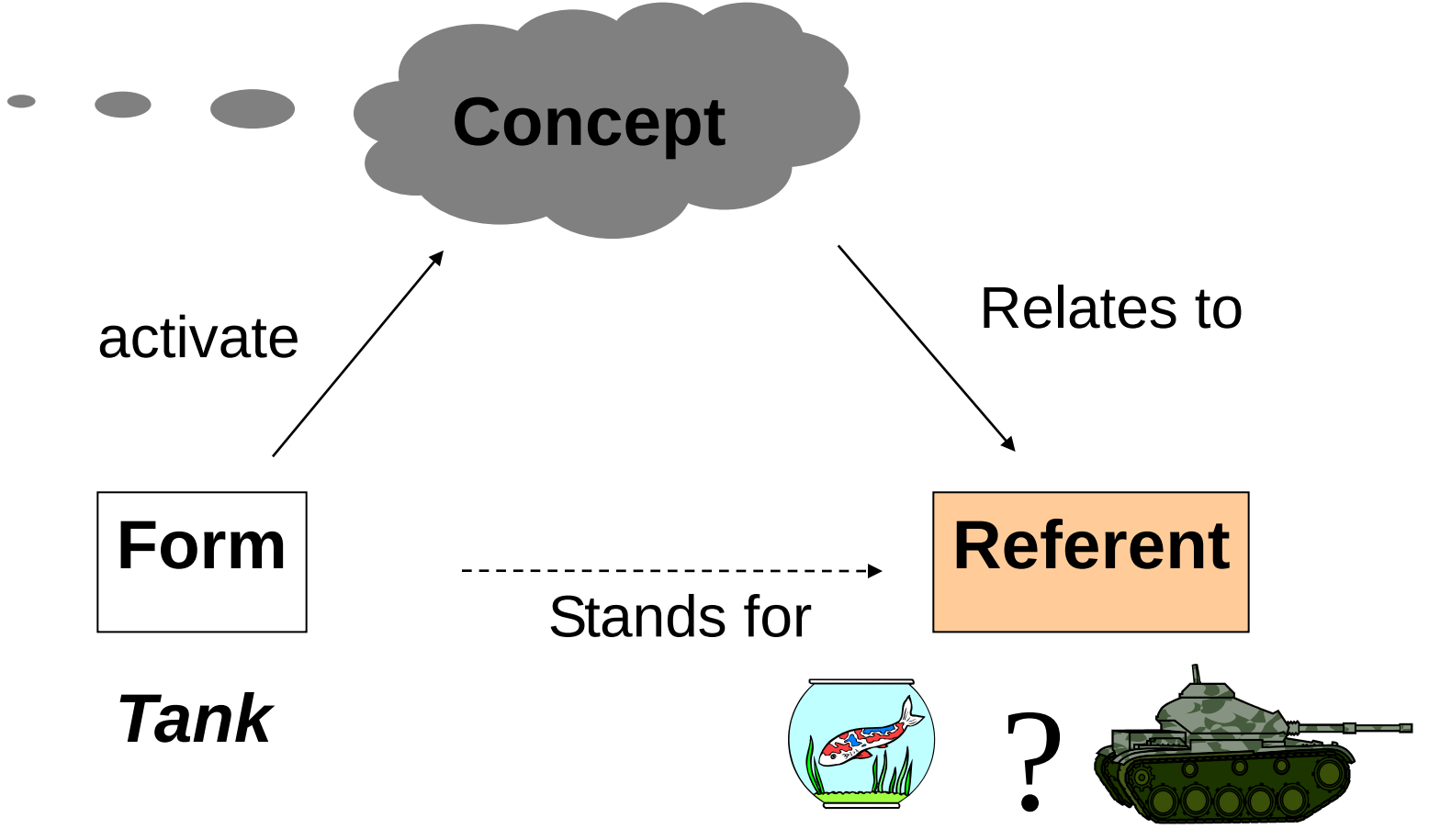
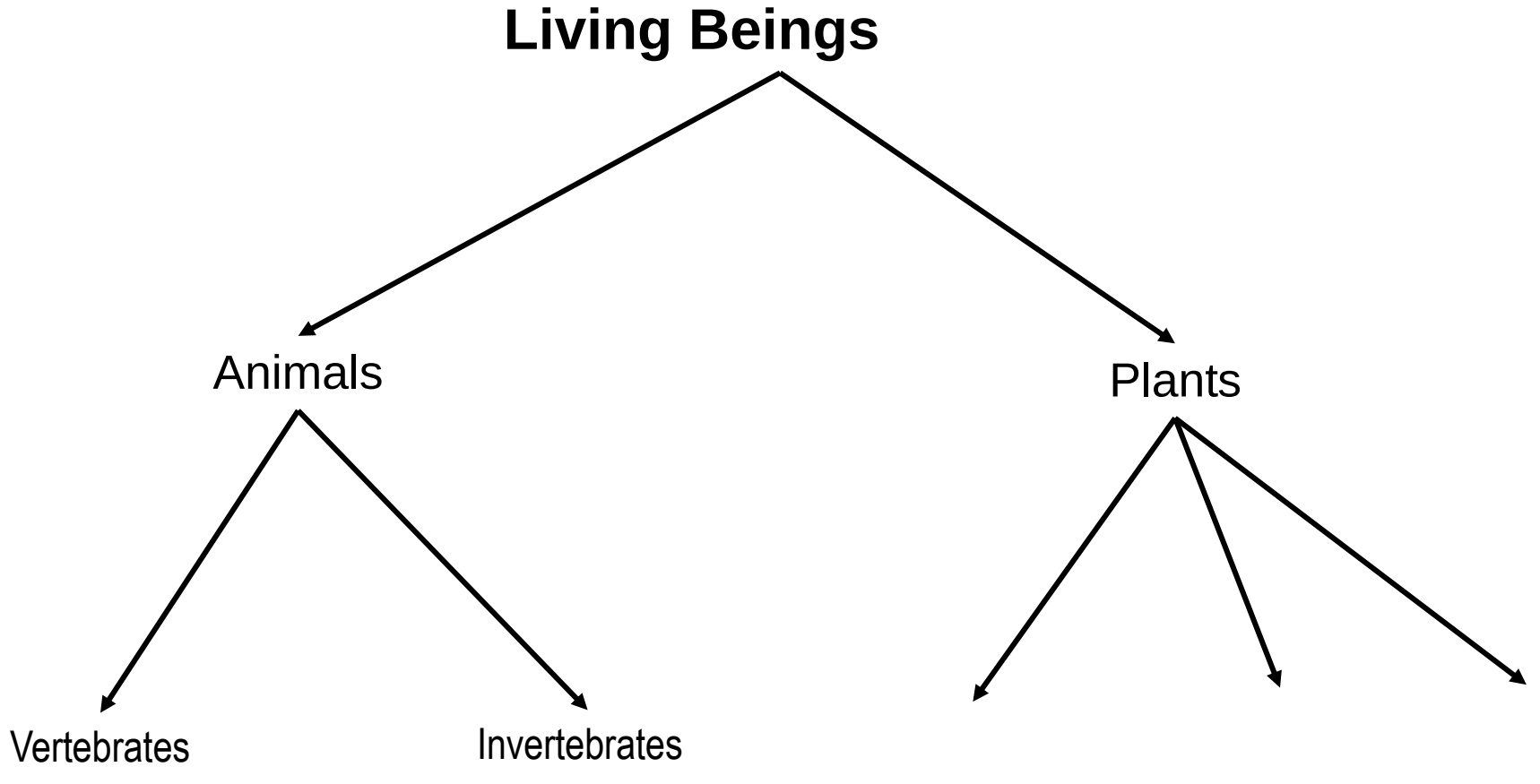


Semantic Services

- Computer science view – an engineering artifact
- A formal specification of a certain domain:
  - Shared understanding of a domain of interest
  - Formal and machine manipulable model of a domain of interest
- Shared *specification of a conceptualisation*
- Defined using RDF(S) or OWL

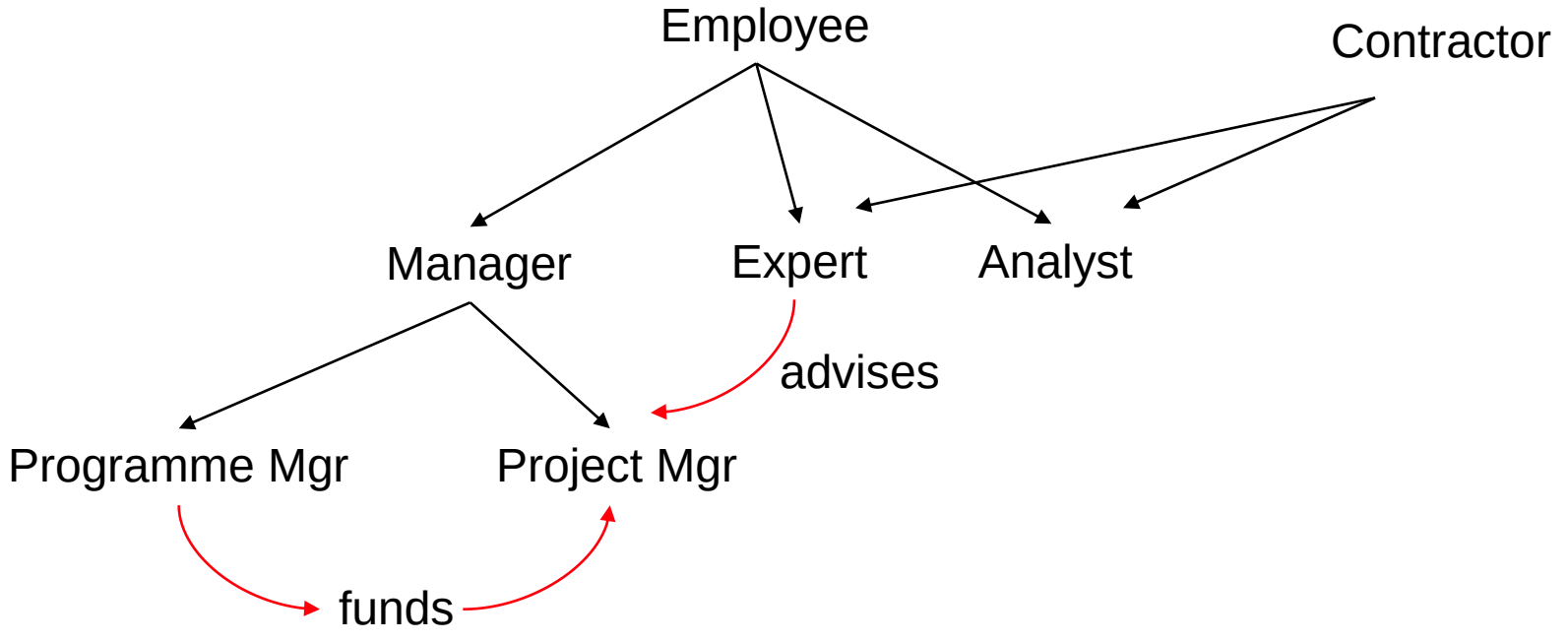
Semantic Services

- Ontology as Taxonomy (simple ontology)



Semantic Services

- Ontology as concept relationships (actors and roles – more complex ontology)



Semantic Services

- Ontology structure – two distinct components:
- Names for important **concepts** in the domain
  - *Elephant* is a concept whose members are a kind of animal
  - *Herbivore* is a concept whose members are exactly those animals who eat only plants or parts of plants
  - *Adult_Elephant* is a concept whose members are exactly those elephants whose age is greater than 20 years

Semantic Services

- Ontology structure – two distinct components:
- Background **knowledge**/constraints on the domain
  - *Adult_Elephants* weigh at least 2,000 kg
  - No individual can be both a *Herbivore* and a *Carnivore*
  - All *Elephants* are either *African_Elephants* or *Indian_Elephants*

Semantic Services

- Ontology design and deployment:
- Design and maintain high quality ontologies, e.g.
  - **Meaningful** — all named classes can have instances
  - **Correct** — captured intuitions of domain experts
  - **Minimally redundant** — no unintended synonyms
  - **Richly axiomatised** — (sufficiently) detailed descriptions

Semantic Services

- Ontology design and deployment:
- Store (large numbers) of instances of ontology classes, e.g. annotations from web pages
- Answer queries over ontology classes and instances, e.g.:
  - Find more general/specific classes
  - Retrieve annotations/pages matching a given description
- Integrate and align multiple ontologies

Semantic Services

- Example ontologies:
- General purpose ontologies
  - WordNet / EuroWordNet, http://www.cogsci.princeton.edu/~wn
  - The Upper Cyc Ontology, http://www.cyc.com/cyc-2-1/index.html
  - IEEE Standard Upper Ontology, http://suo.ieee.org/
- Ontologies in a wider sense
  - Agrovoc, http://www.fao.org/agrovoc/
  - Art and Architecture, http://www.getty.edu/research/tools/vocabulary/aat/
  - UNSPSC, http://eccma.org/unspsc/

Semantic Services

- Example ontologies:
- Domain and application-specific ontologies
  - RDF Site Summary RSS, http://groups.yahoo.com/group/rss-dev/files/schema.rdf
  - RETSINA Calendering Agent, http://ilrt.org/discovery/2001/06/schemas/ical-full/hybrid.rdf
  - AIFB Web Page Ontology, http://ontobroker.semanticweb.org/ontos/aifb.html
  - Dublin Core, http://dublincore.org/
  - UMLS, http://www.nlm.nih.gov/research/umls/
  - Open Biological Ontologies: http://obo.sourceforge.net/

Resource Description Framework (RDF)

Web Ontology Language (OWL)

RDF

- W3C standard
- Relationships between documents
- Consisting of triples or sentences:

  <subject, property, verb>
  <Tolkien, wrote, The Lord of the Rings>

- RDFS extends RDF with standard "ontology vocabulary":
  - Class, Property
  - Type, subClassOf
  - domain, range

RDF

- An example:

"Tolkein wrote ISBN00001047582"

hasWritten
('http://www.famouswriters.org/tolkein/',
http://www.books.org/ISBN00001047582')

RDF

- RDF(S) = RDF + RDFS
- RDFS defines the ontology
  - Classes and their properties and relationships
  - What concepts to reason about and how are they related
  - Ex: there are authors, and authors write books
- RDF defines the instances and their properties
  - Mark Twain is an author
  - Mark Twain wrote “Adventures of Tom Sawyer”
  - “Adventures of Tom Sawyer” is a book

RDF

hasName
(‘http://www.famouswriters.org/twain/mark’,
“Mark Twain”)

hasWritten
(‘http://www.famouswriters.org/twain/mark’,
‘http://www.books.org/ISBN00001047582’)

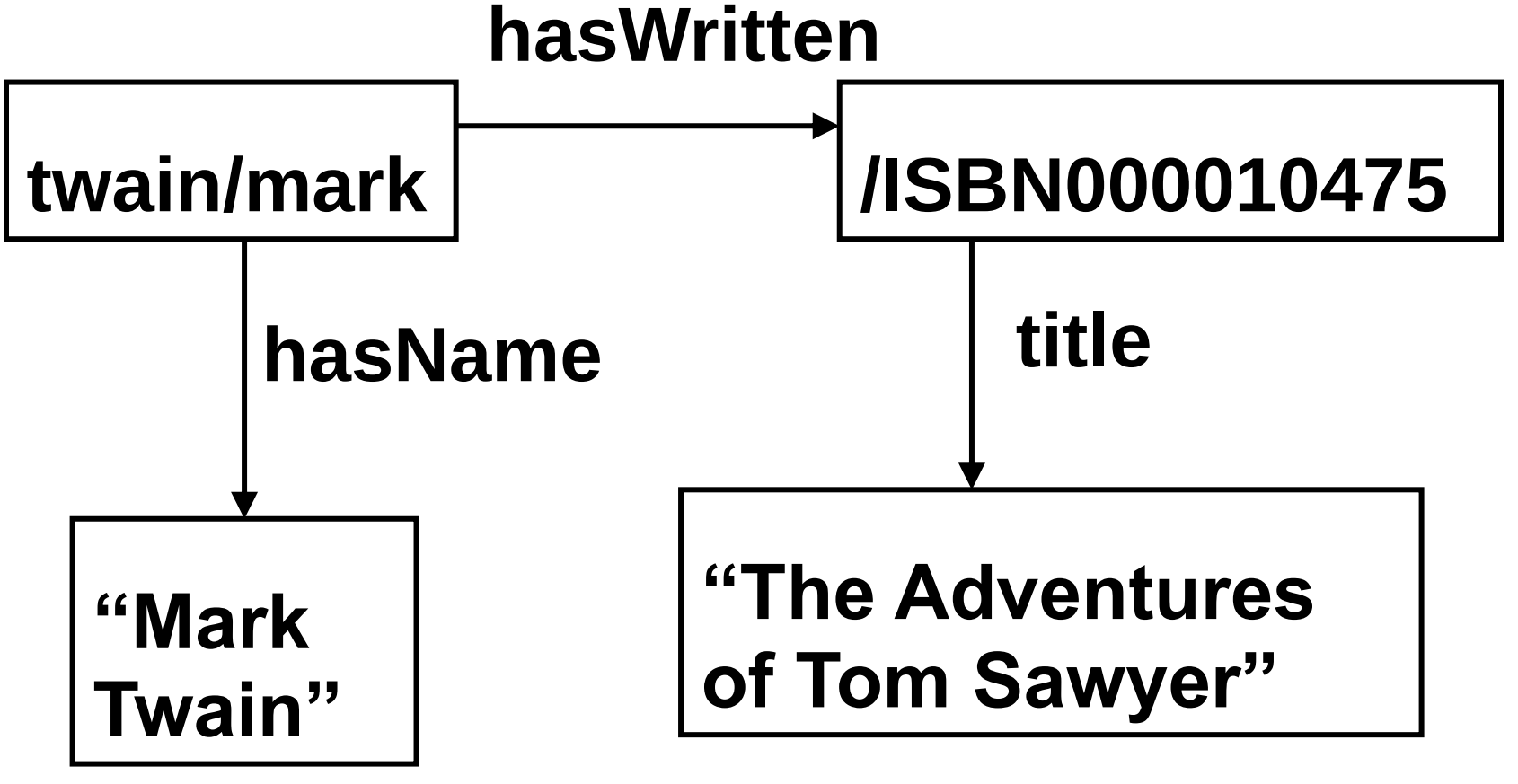
title
(‘http://www.books.org/ISBN00001047582’,
“The Adventures of Tom Sawyer”)

XML version:

```
<rdf:Description rdf:about=http://www.famouswriters.org/twain/mark>
    <s:hasName>Mark Twain</s:hasName>
    <s:hasWritten rdf:resource=http://www.books.org/ISBN0001047/>
</rdf:Description>
```

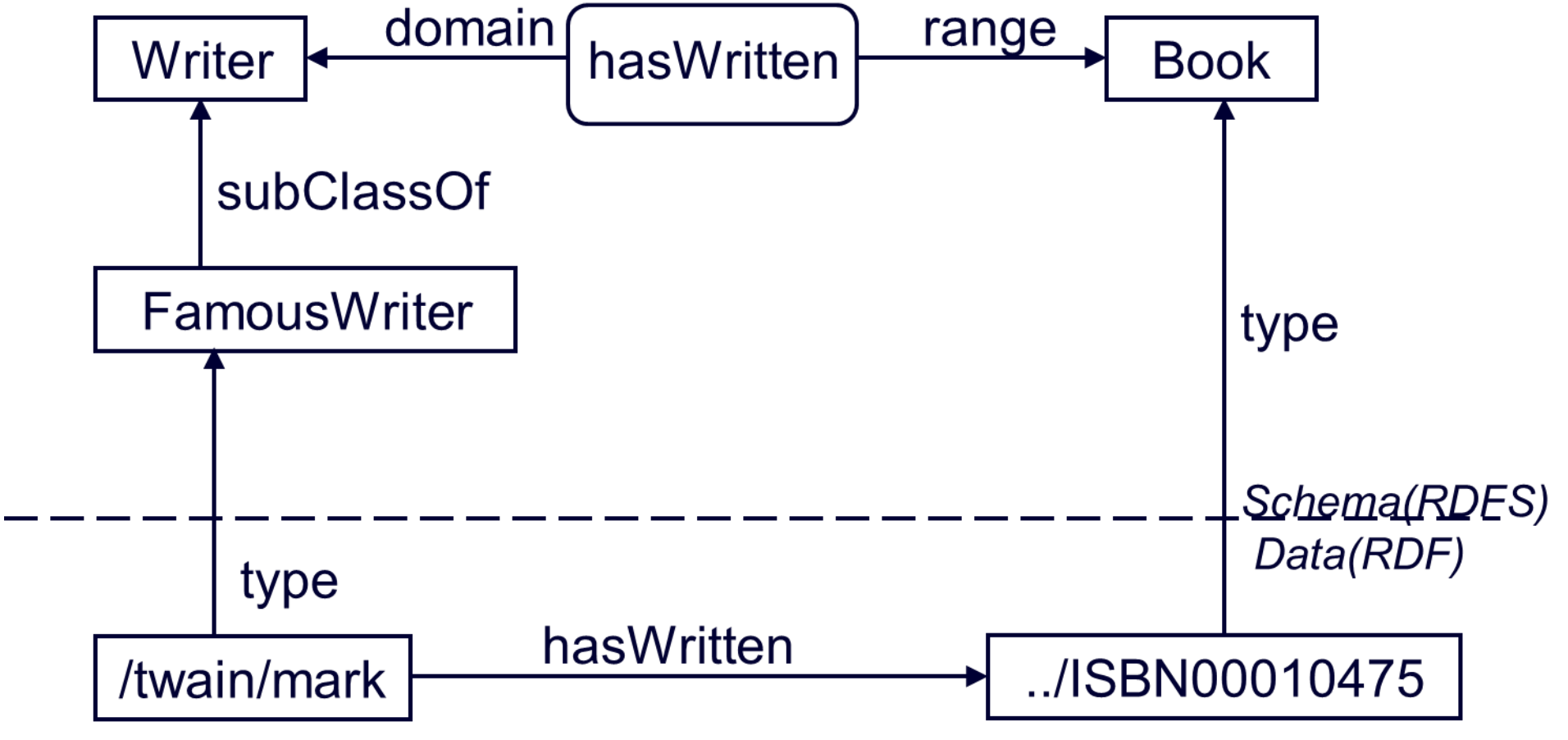
RDF

- RDF data graph



RDF

- RDF schema example



RDF

- RDF is next step from XML
- Possible to define vocabulary
- No precisely defined meaning
- No inference model

What about OWL?

OWL

- Based on SHIQ **Description Logic** knowledge representation formalism
- Well defined semantics
- Well understood formal properties
- Known reasoning algorithms
- Highly optimized existing implementations
- OWL full, OWL DL, OWL Lite

OWL

- Reasoning over ontologies
- Inference capabilities

X is author of Y ⇨ Y is written by X

X is supplier to Y; Y is supplier to Z ⇨
X and Z are part of the same supply chain

Cars are a kind of vehicle;
Vehicles have 2 or more wheels ⇨ Cars have 2 or more wheels

Back to Services to Conclude ...

Semantic Services

- Automatic discovery

  Find a book selling service

- Automatic invocation

  Purchase the latest Delia Smith book

- Automatic composition and interoperation

  Purchase the cheapest latest Delia Smith book

- Automatic execution monitoring

  What is the status of my book order?