Semantic Web

Introduction

Where are we?

#	Title
1	Introduction
2	**Semantic Web Architecture**
3	Resource Description Framework (RDF)
4	Web of data
5	Generating Semantic Annotations
6	Storage and Querying
7	Web Ontology Language (OWL)
8	Rule Interchange Format (RIF)
9	Reasoning on the Web
10	Ontologies
11	Social Semantic Web
12	Semantic Web Services
13	Tools
14	Applications

Agenda

1. Motivation
    1. Development of the Web
        1. Internet
        2. Web 1.0
        3. Web2.0
    2. Limitations of the current Web
2. Technical solution
    1. Introduction to Semantic Web
    2. Semantic Web – architecture and languages
    3. Semantic Web - data
    4. Semantic Web – processes
3. Recent trends
4. Summary
5. References

DEVELOPMENT OF THE WEB

Development of the Web

1. Internet
2. Web 1.0
3. Web 2.0

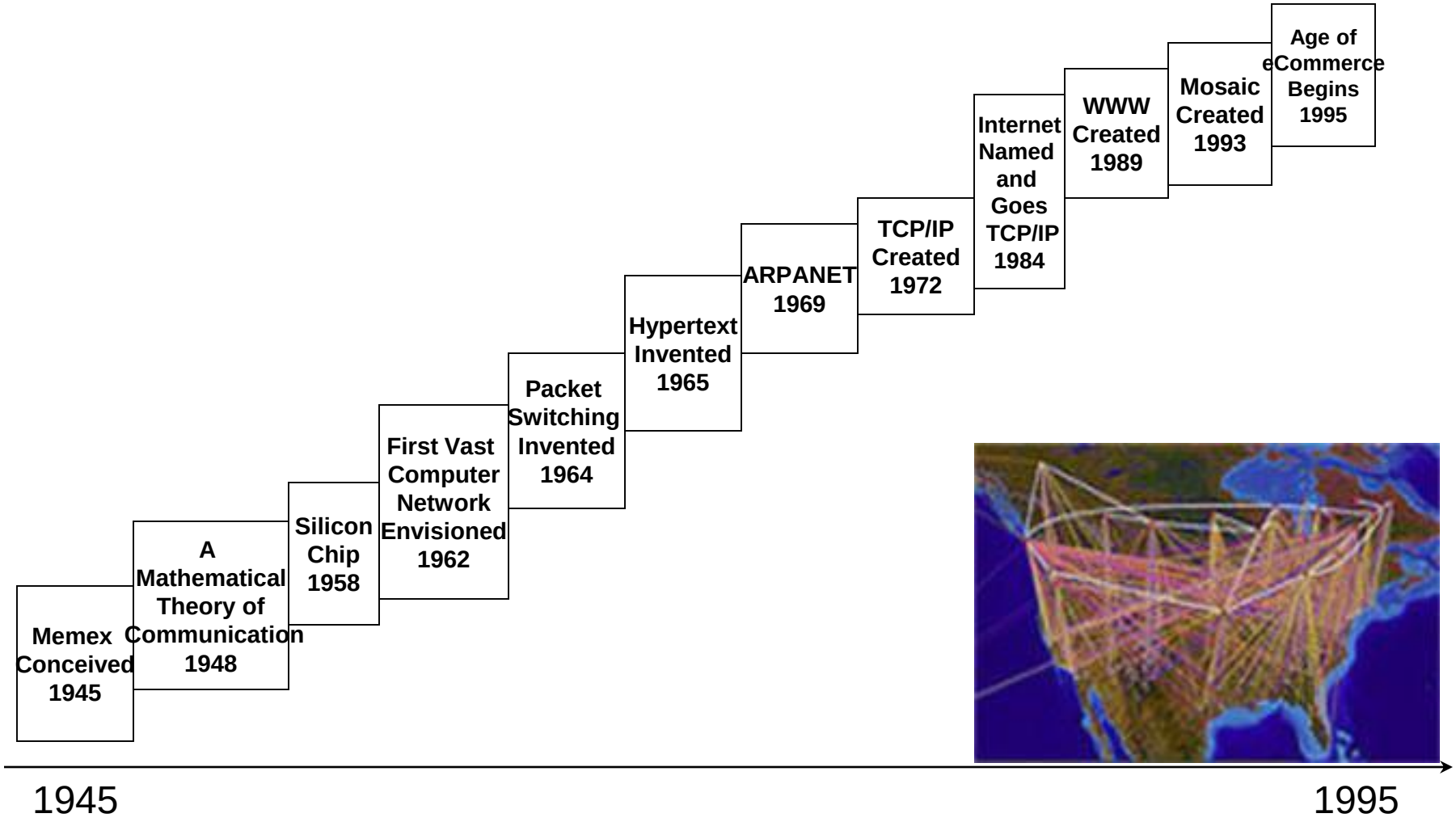
INTERNET

Internet

- “The **Internet** is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private and public, academic, business, and government networks of local to global scope that are linked by a broad array of electronic and optical networking technologies.”

http://en.wikipedia.org/wiki/Internet

A brief summary of Internet evolution



Source: http://www.isoc.org/internet/history2002_0918_Internet_History_and_Growth.ppt

WEB 1.0

Web 1.0

- “The **World Wide Web** ("**WWW**" or simply the "**Web**") is a system of interlinked, hypertext documents that runs over the Internet. With a Web browser, a user views Web pages that may contain text, images, and other multimedia and navigates between them using hyperlinks”.

http://en.wikipedia.org/wiki/World_Wide_Web

Web 1.0

- **Netscape**
  - *Netscape* is associated with the breakthrough of the Web.
  - *Netscape* had rapidly a large user community making attractive for others to present their information on the Web.

- **Google**
  - *Google* is the incarnation of Web 1.0 mega grows
  - *Google* indexed already in 2008 more than 1 trillion pages [*]
  - *Google* and other similar search engines turned out that a piece of information can be faster found again on the Web than in the own bookmark list

Google

[*] http://googleblog.blogspot.com/2008/07/we-knew-web-was-big.html

Web 1.0 principles

- The success of Web1.0 is based on three simple principles:
  1. A simple and uniform addressing schema to indentify information chunks i.e. ***Uniform Resource Identifiers (URIs)***
  2. A simple and uniform representation formalism to structure information chunks allowing browsers to render them i.e. ***Hyper Text Markup Language (HTML)***
  3. A simple and uniform protocol to access information chunks i.e. ***Hyper Text Transfer Protocol (HTTP)***

1. Uniform Resource Identifiers (URIs)

- Uniform Resource Identifiers (URIs) are used to name/identify resources on the Web
- URIs are pointers to resources to which request methods can be applied to generate potentially different responses
- Resource can reside anywhere on the Internet
- Most popular form of a URI is the Uniform Resource Locator (URL)

2. Hyper-Text Markup Language (HTML)

- Hyper-Text Markup Language:
  - A subset of Standardized General Markup Language (SGML)
  - Facilitates a hyper-media environment
- Documents use elements to “mark up” or identify sections of text for different purposes or display characteristics
- HTML markup consists of several types of entities, including: elements, attributes, data types and character references
- Markup elements are not seen by the user when page is displayed
- Documents are rendered by browsers

3. Hyper-Text Transfer Protocol (HTTP)

- Protocol for client/server communication
  - The heart of the Web
  - Very simple request/response protocol
    - Client sends request message, server replies with response message
  - Provide a way to publish and retrieve HTML pages
  - Stateless
  - Relies on URI naming mechanism

WEB 2.0

Web 2.0

- “The term "**Web 2.0**" (2004–present) is commonly associated with web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web”

http://en.wikipedia.org/wiki/Web_2.0

Web 2.0

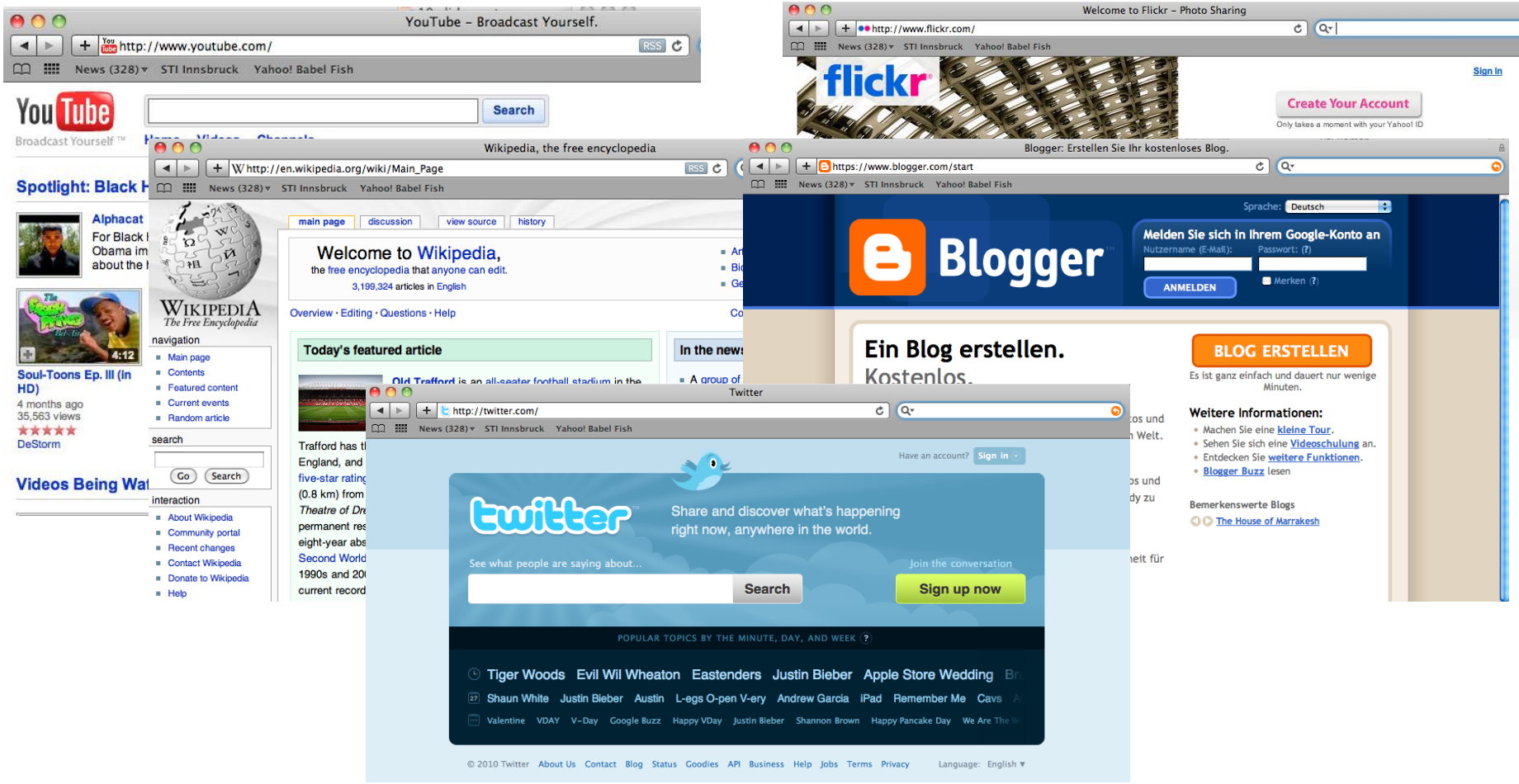
- Web 2.0 is a vaguely defined phrase referring to various topics such as social networking sites, wikis, communication tools, and folksonomies.
- Tim Berners-Lee is right that all these ideas are already underlying his original web ideas, however, there are differences in emphasis that may cause a qualitative change.
- With Web 1.0 technology a significant amount of software skills and investment in software was necessary to publish information.
- Web 2.0 technology changed this dramatically.

Web 2.0 major breakthroughs

- The four major breakthroughs of Web 2.0 are:
    1. Blurring the distinction between content consumers and content providers.
    2. Moving from media for individuals towards media for communities.
    3. Blurring the distinction between service consumers and service providers
    4. Integrating human and machine computing in a new and innovative way

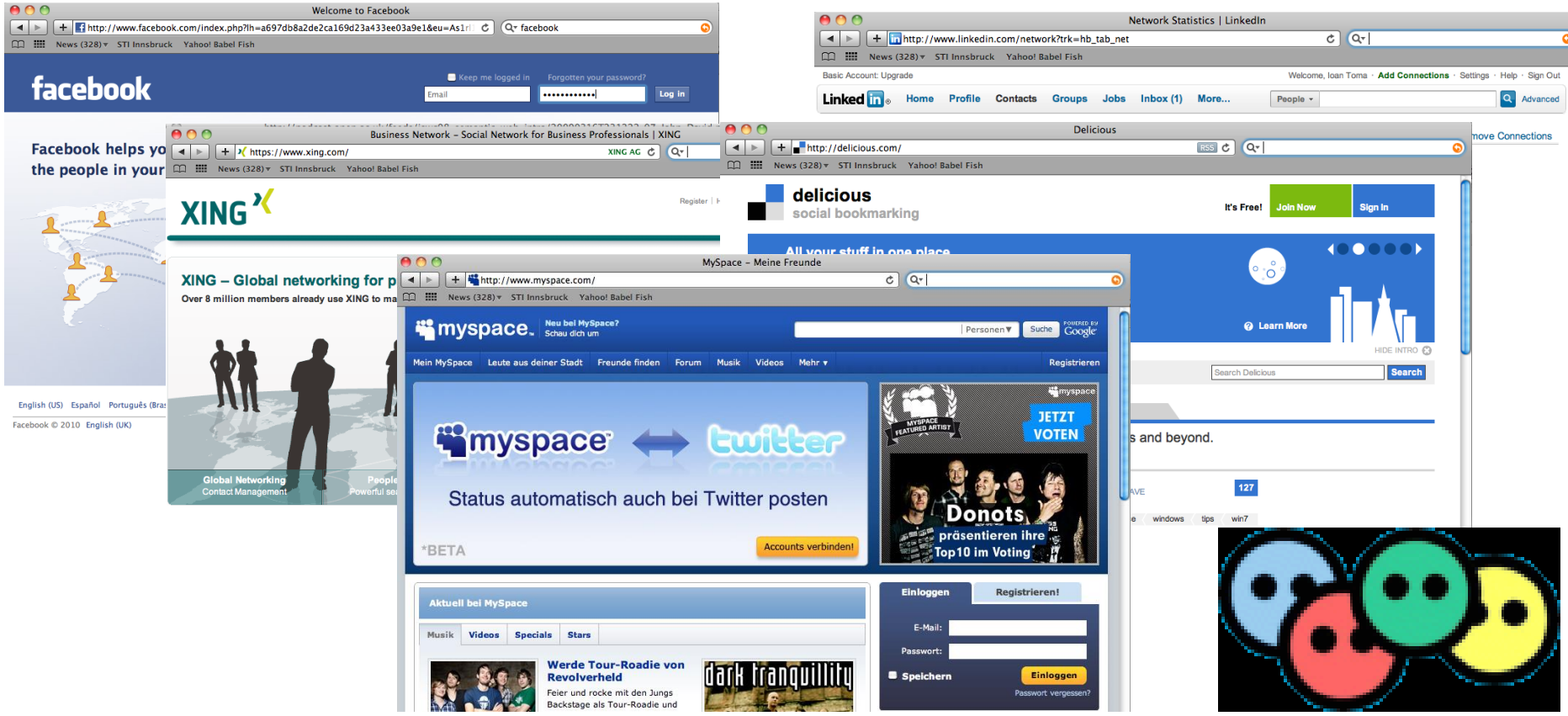
1. Blurring the distinction between content consumers and content providers

Wiki, Blogs, and Twiter turned the publication of text in mass phenomena, as flickr and youtube did for multimedia



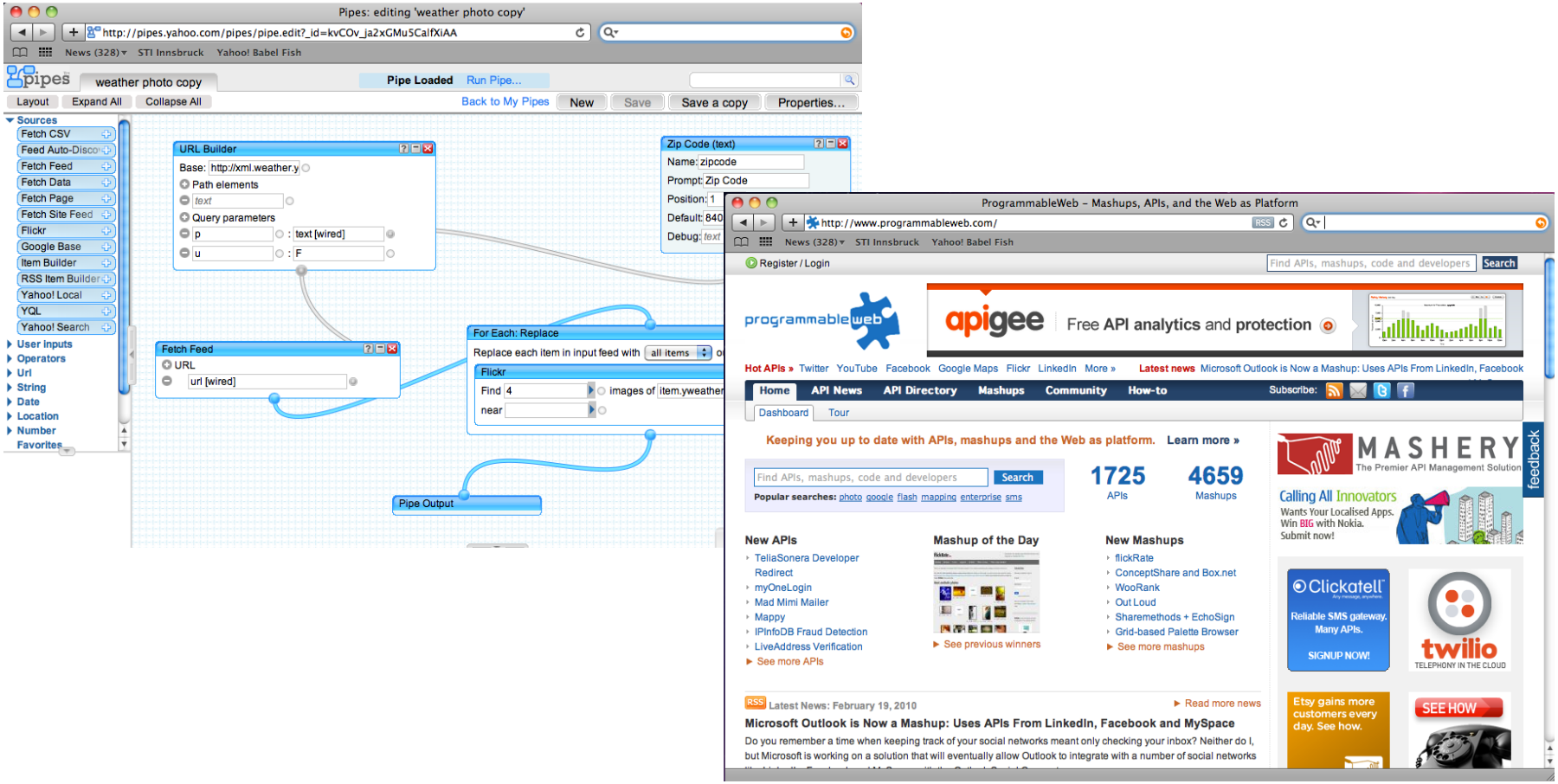
2. Moving from a media for individuals towards a media for communities

Social web sites such as del.icio.us, facebook, FOAF, linkedin, myspace and Xing allow communities of users to smoothly interweave their information and activities



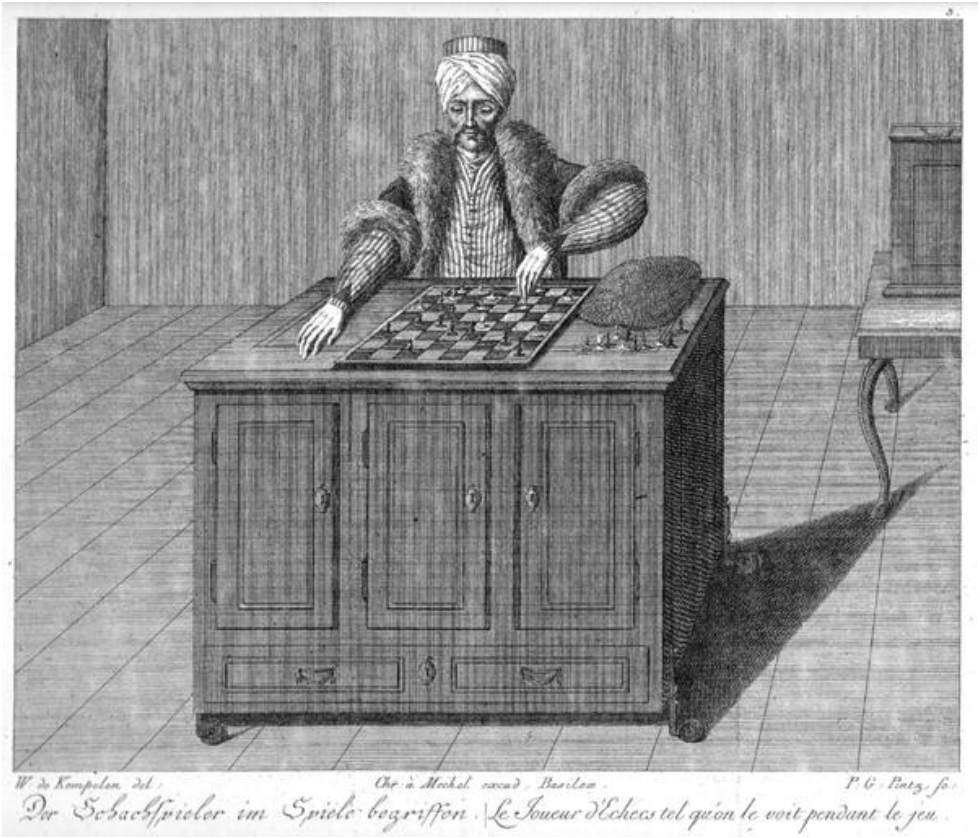
3. Blurring the distinction between service consumers and service providers

Mashups allow web users to easy integrate services in their web site that were implemented by third parties



4. Integrating human and machine computing in a new way

Amazon Mechanical Turk - allows to access human services through a web service interface blurring the distinction between manually and automatically provided services



LIMITATIONS OF THE CURRENT WEB

Limitations of the current Web

- The current Web has its limitations when it comes to:
  1. finding relevant information
  2. extracting relevant information
  3. combining and reusing information

Limitations of the current Web

Finding relevant information

- Finding information on the current Web is based on keyword search
- Keyword search has a limited recall and precision due to:
  - ***Synonyms***:
    - e.g. Searching information about “Cars” will ignore Web pages that contain the word “Automobiles” even though the information on these pages could be relevant
  - ***Homonyms:***
    - e.g. Searching information about “Jaguar” will bring up pages containing information about both “Jaguar” (the car brand) and “Jaguar” (the animal) even though the user is interested only in one of them

Limitations of the current Web

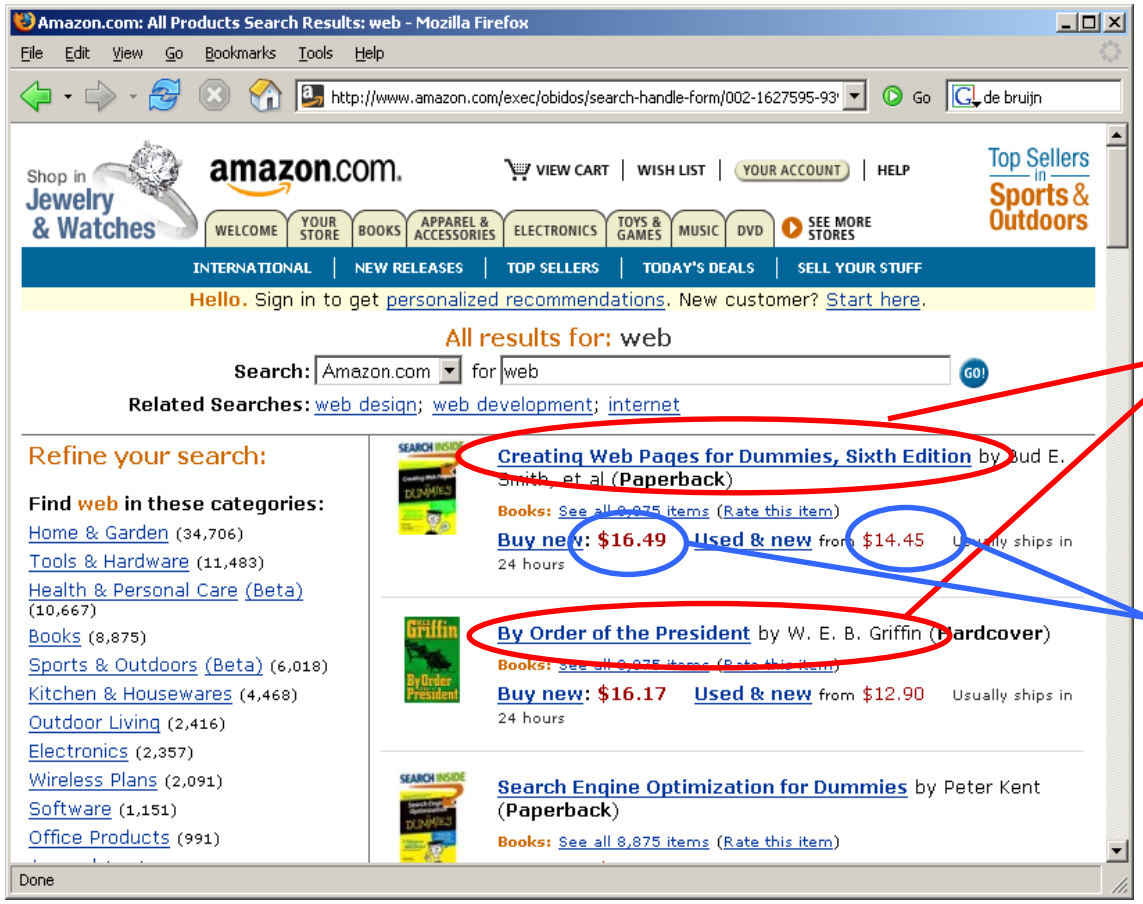
Finding relevant information

- Keyword search has a limited recall and precision due also to:
  - ***Spelling variants:***
    - e.g. “organize” in American English vs. “organise” in British English
  - ***Spelling mistakes***
  - ***Multiple languages***
    - i.e. information about same topics in published on the Web on different languages (English, German, Italian,…)
- Current search engines provide no means to specify the relation between a resource and a term
  - e.g. sell / buy

Limitations of the current Web

Extracting relevant information

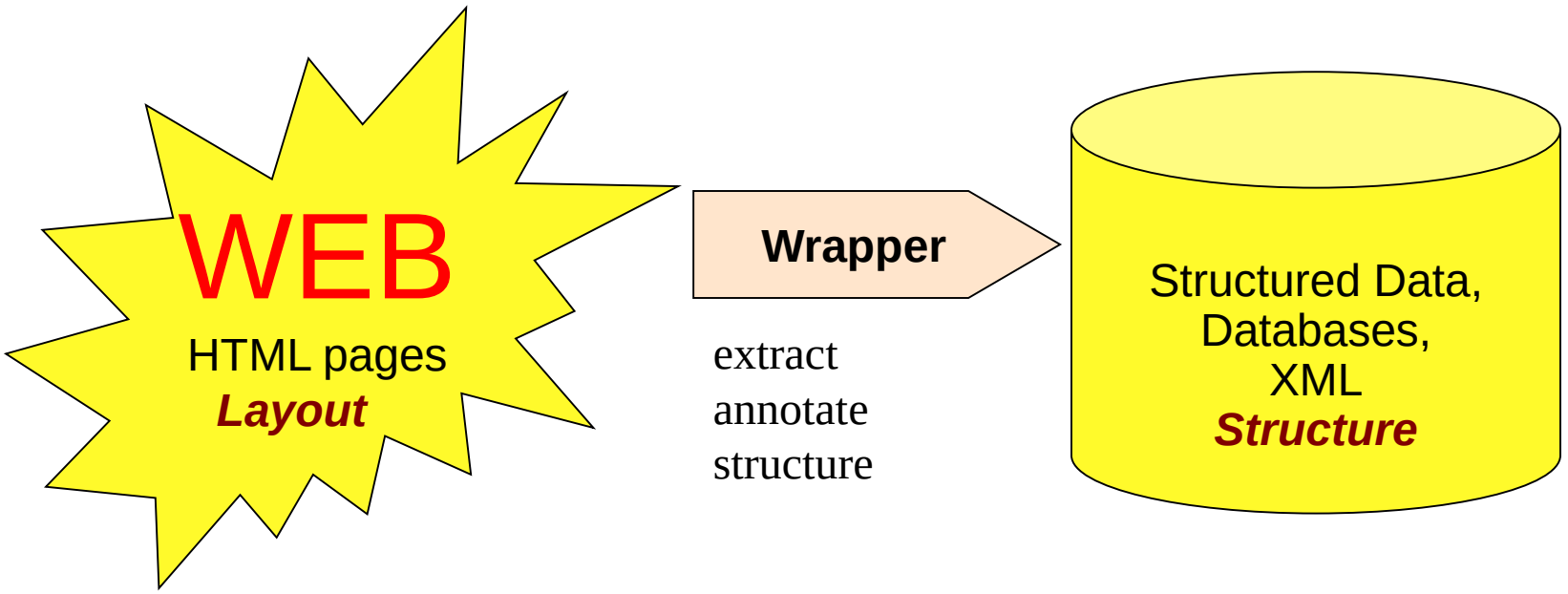
- One-fit-all automatic solution for extracting information from Web pages is not possible due to different formats, different syntaxes
- Even from a single Web page is difficult to extract the relevant information



Limitations of the current Web

Extracting relevant information

- Extracting information from current web sites can be done using ***wrappers***



Limitations of the current Web

Extracting relevant information

- The actual extraction of information from web sites is specified using standards such as XSL Transformation (XSLT) [1]
- Extracted information can be stored as structured data in XML format or databases.
- However, using wrappers do not really scale because the actual extraction of information depends again on the web site format and layout

[1] http://www.w3.org/TR/xslt

Limitations of the current Web

Combining and reusing information

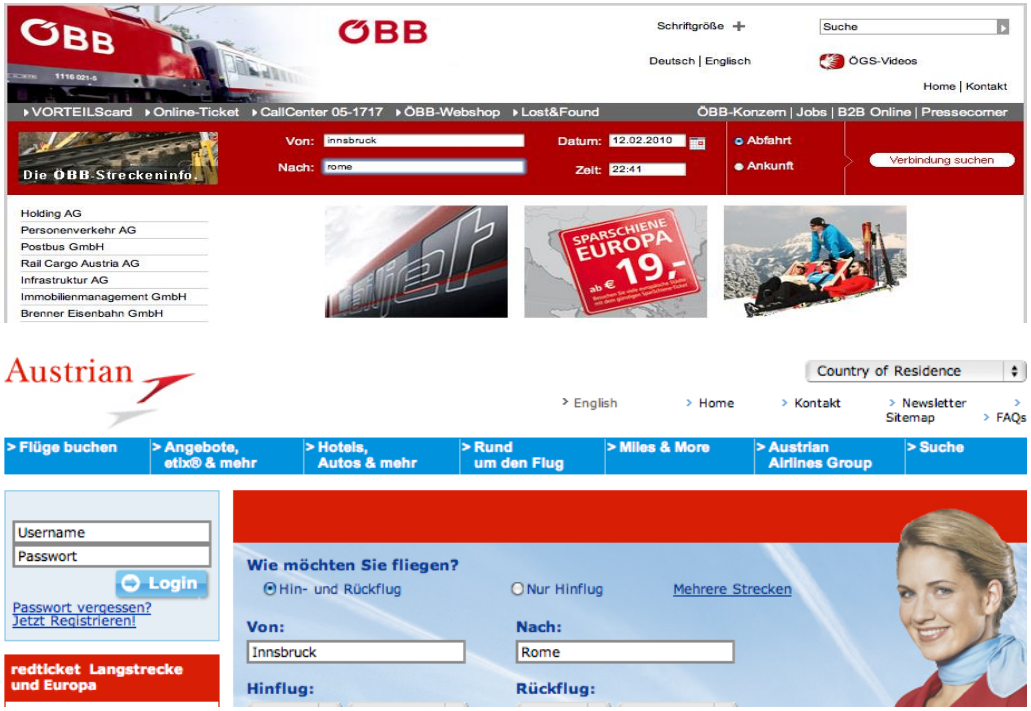
- Tasks often require to combine data on the Web
  1. Searching for the same information in different digital libraries
  2. Information may come from different web sites and needs to be combined

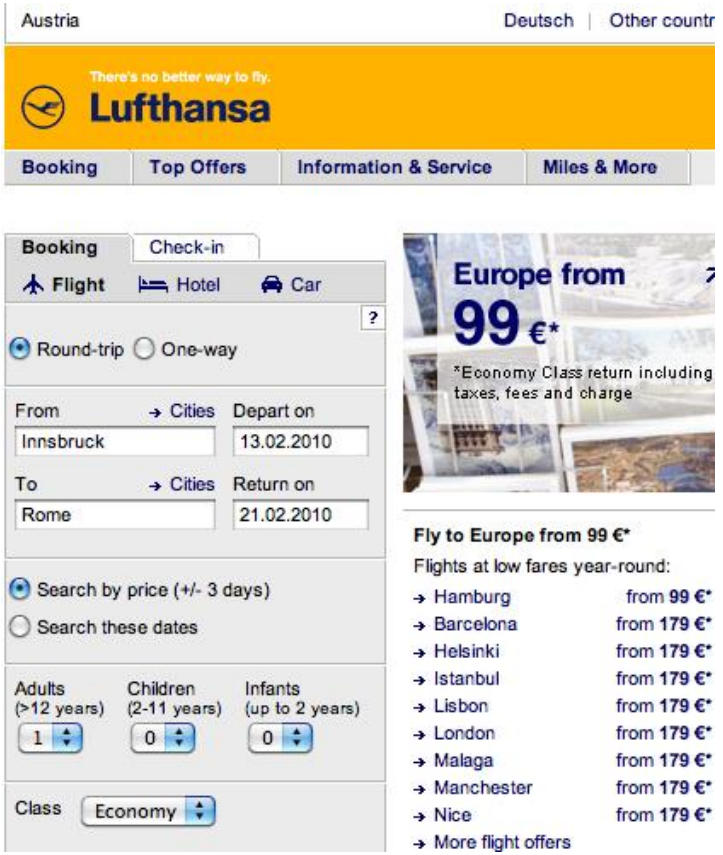
Limitations of the current Web

Combining and reusing information

1. Searches for the same information in different digital libraries

Example: I want travel from Innsbruck to Rome.



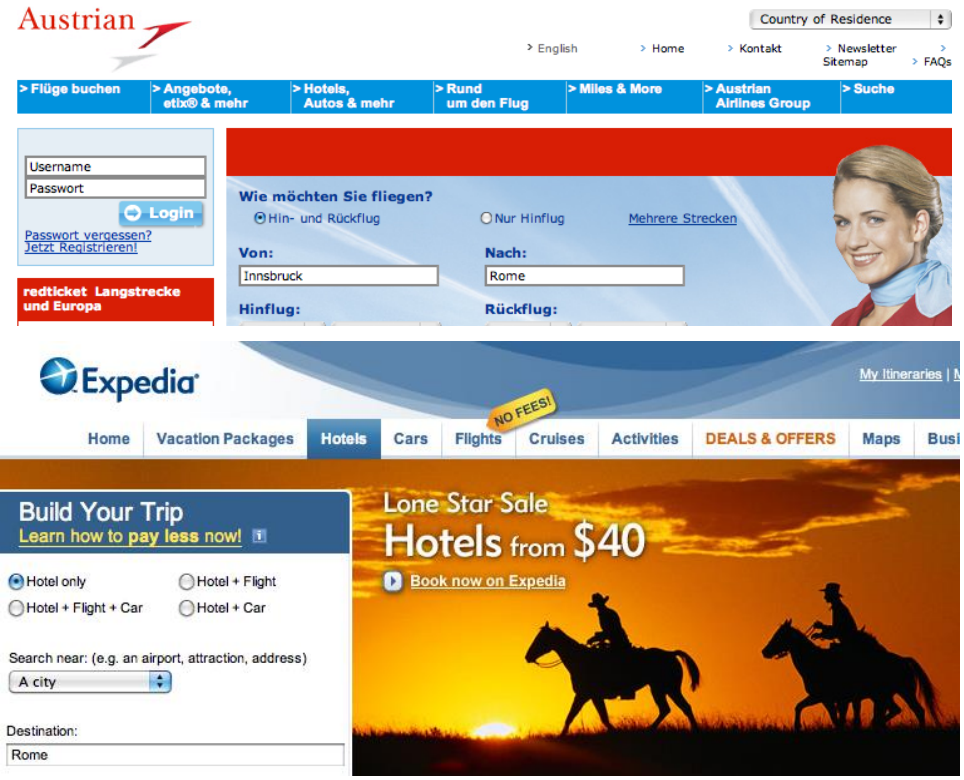


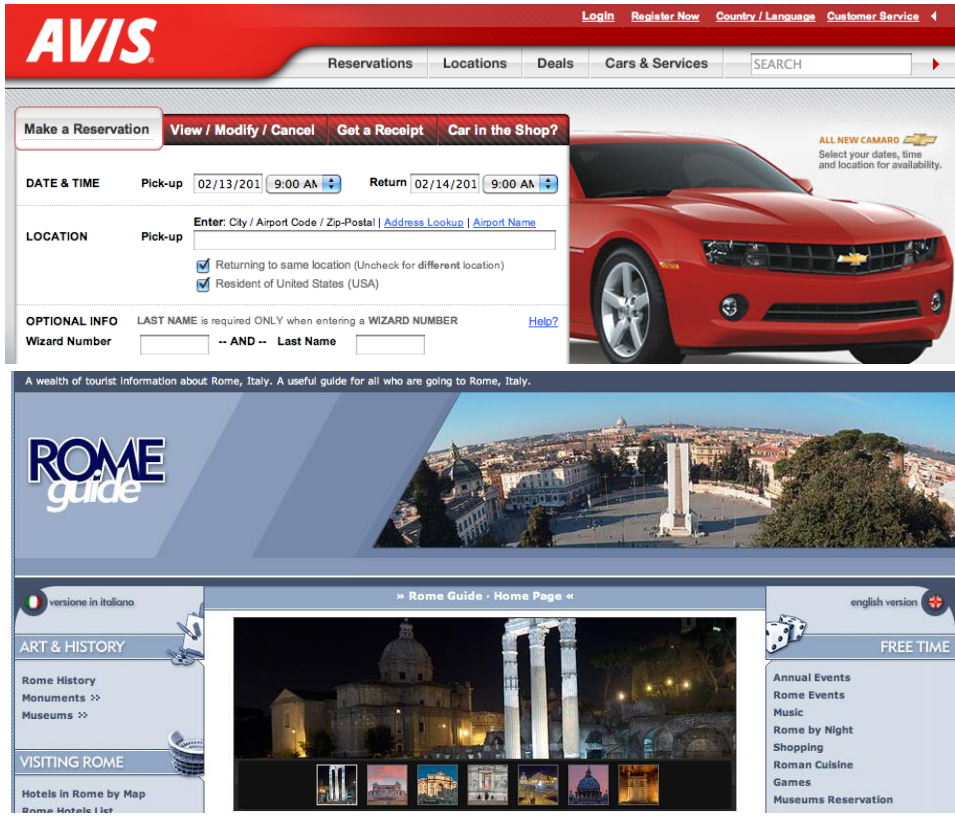
Limitations of the current Web

Combining and reusing information

2. Information may come from different web sites and needs to be combined

Example: I want to travel from Innsbruck to Rome where I want to stay in a hotel and visit the city





How to improve current Web?

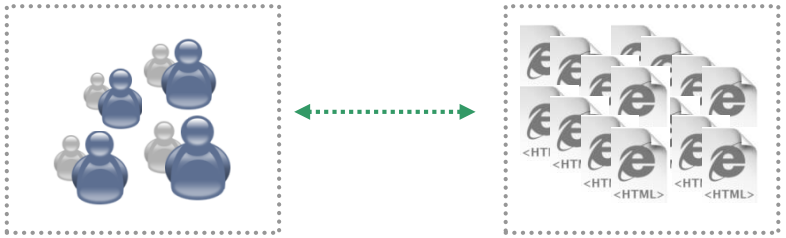
- Increasing automatic linking among data
- Increasing recall and precision in search
- Increasing automation in data integration
- Increasing automation in the service life cycle

- Adding semantics to data and services is the solution!

TECHNICAL SOLUTION

INTRODUCTION TO SEMANTIC WEB

The Vision



More than 2 billion users

more than 50 billion pages

Static

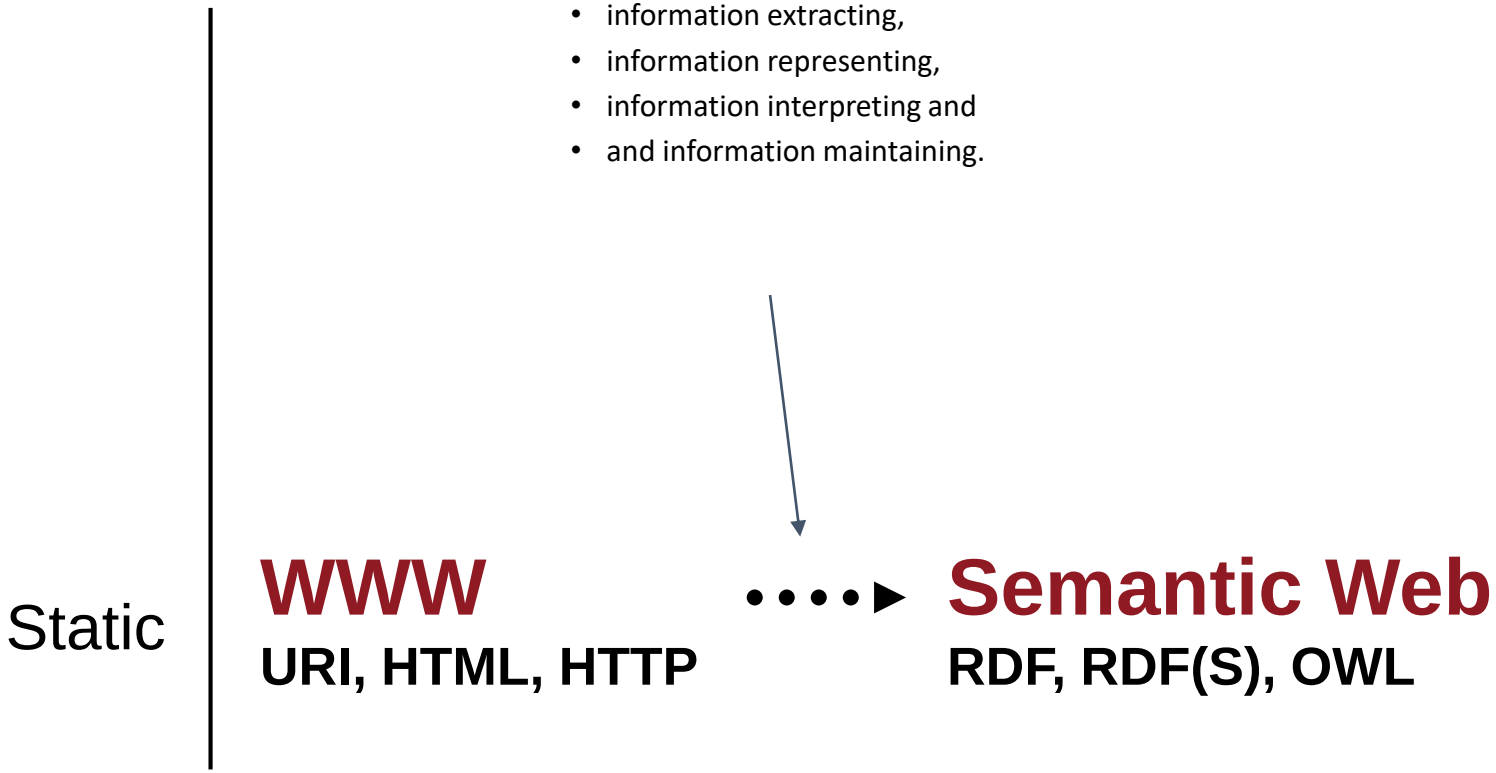
WWW

URI, HTML, HTTP

The Vision (contd.)

Serious problems in

- information finding,
- information extracting,
- information representing,
- information interpreting and
- and information maintaining.



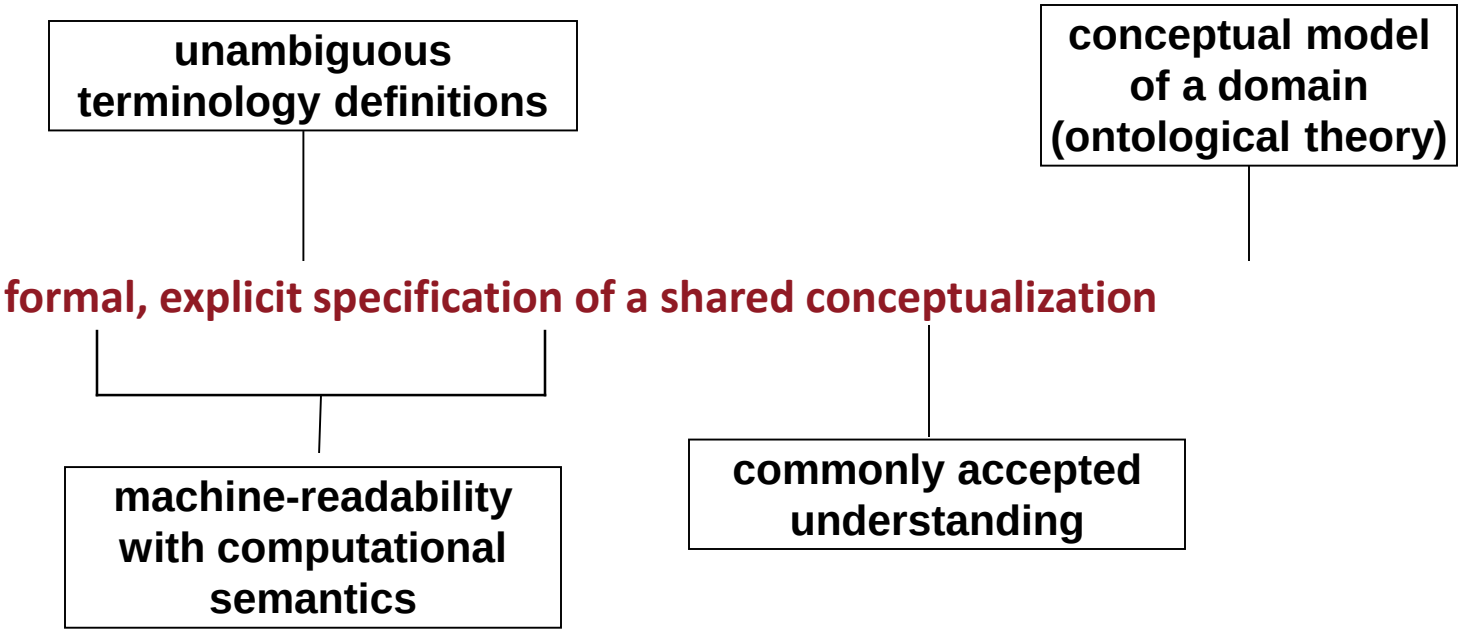
What is the Semantic Web?

- *"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 cooperation."*
  T. Berners-Lee, J. Hendler, O. Lassila, "The Semantic Web", Scientific American, May 2001

What is the Semantic Web?

- The next generation of the WWW
- Information has machine-processable and machine-understandable semantics
- Not a separate Web but an augmentation of the current one
- The backbone of Semantic Web are ***ontologies***

Ontology definition



Gruber, “Toward principles for the design of ontologies used or knowledge sharing?” , Int. J. Hum.-Comput. Stud., vol. 43, no. 5-6,1995

… "well-defined meaning" …

- *"An ontology is an **explicit specification** of a **conceptualization**"*
  Gruber, "Toward principles for the design of ontologies used for knowledge sharing?" , Int. J. Hum.-Comput. Stud., vol. 43, no. 5-6,1995.
- Ontologies are the modeling foundations to Semantic Web
  - They provide the ***well-defined meaning*** for information

… explicit, … specification, … conceptualization, …

An ontology is:

- A conceptualization
  - An ontology is a model of the most relevant concepts of a phenomenon from the real world
- Explicit
  - The model explicitly states the type of the concepts, the relationships between them and the constraints on their use
- Formal
  - The ontology has to be machine readable (the use of the natural language is excluded)
- Shared
  - The knowledge contained in the ontology is consensual, i.e. it has been accepted by a group of people.

Studer, Benjamins, D. Fensel, “Knowledge engineering: Principles and methods”, Data Knowledge Engineering, vol. 25, no. 1-2, 1998.

Ontology example

Concept

conceptual entity of the domain

Property

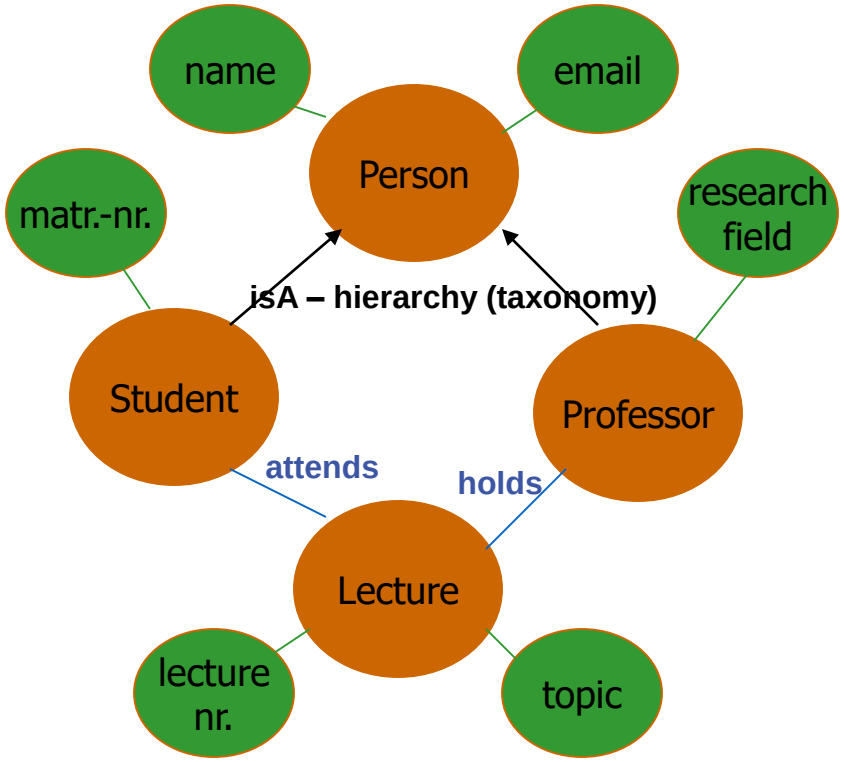
attribute describing a concept

Relation

relationship between concepts or properties

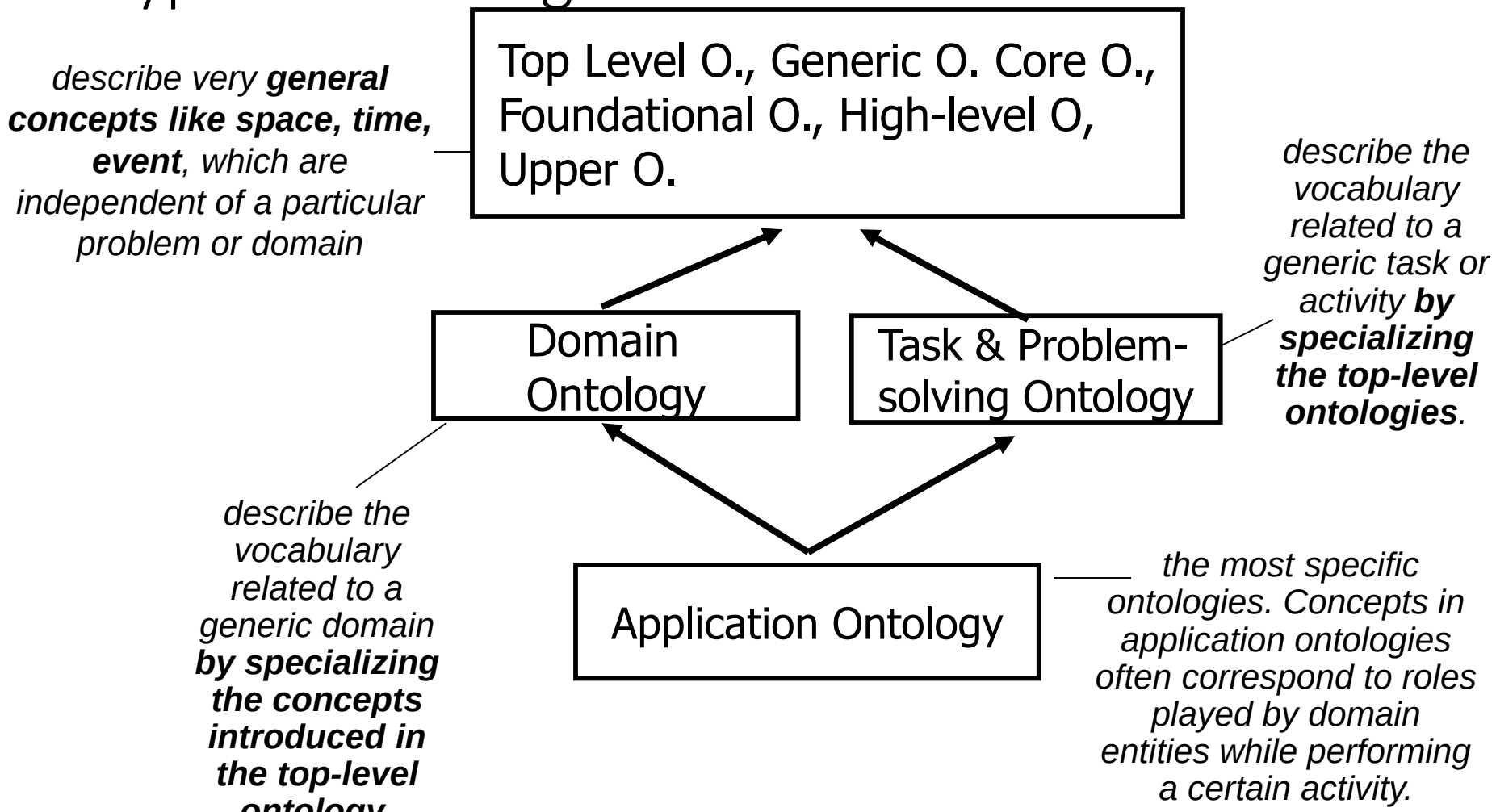
Axiom

coherency description between Concepts / Properties / Relations via logical expressions



holds(Professor, Lecture) =>
Lecture.topic = Professor.researchField

Types of ontologies



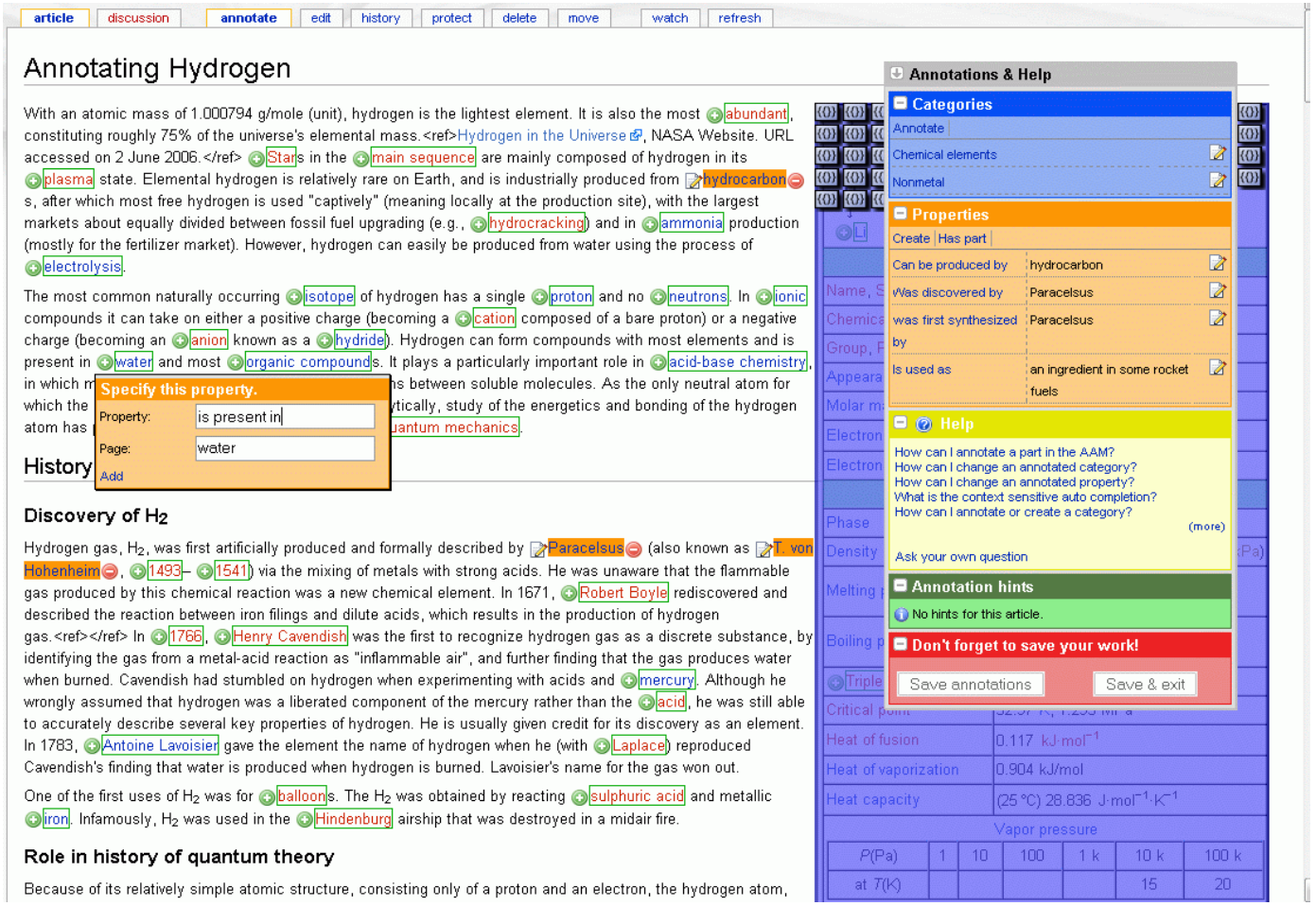
[Guarino, 98] Formal Ontology in Information Systems

http://www.loa-cnr.it/Papers/FOIS98.pdf

The Semantic Web is about…

- Web Data Annotation
  - connecting (syntactic) Web objects, like text chunks, images, … to their semantic notion (e.g., this image is about Innsbruck, Dieter Fensel is a professor)
- Data Linking on the Web (Web of Data)
  - global networking of knowledge through URI, RDF, and SPARQL (e.g., connecting my calendar with my rss feeds, my pictures, ...)
- Data Integration over the Web
  - seamless integration of data based on different conceptual models (e.g., integrating data coming from my two favorite book sellers)

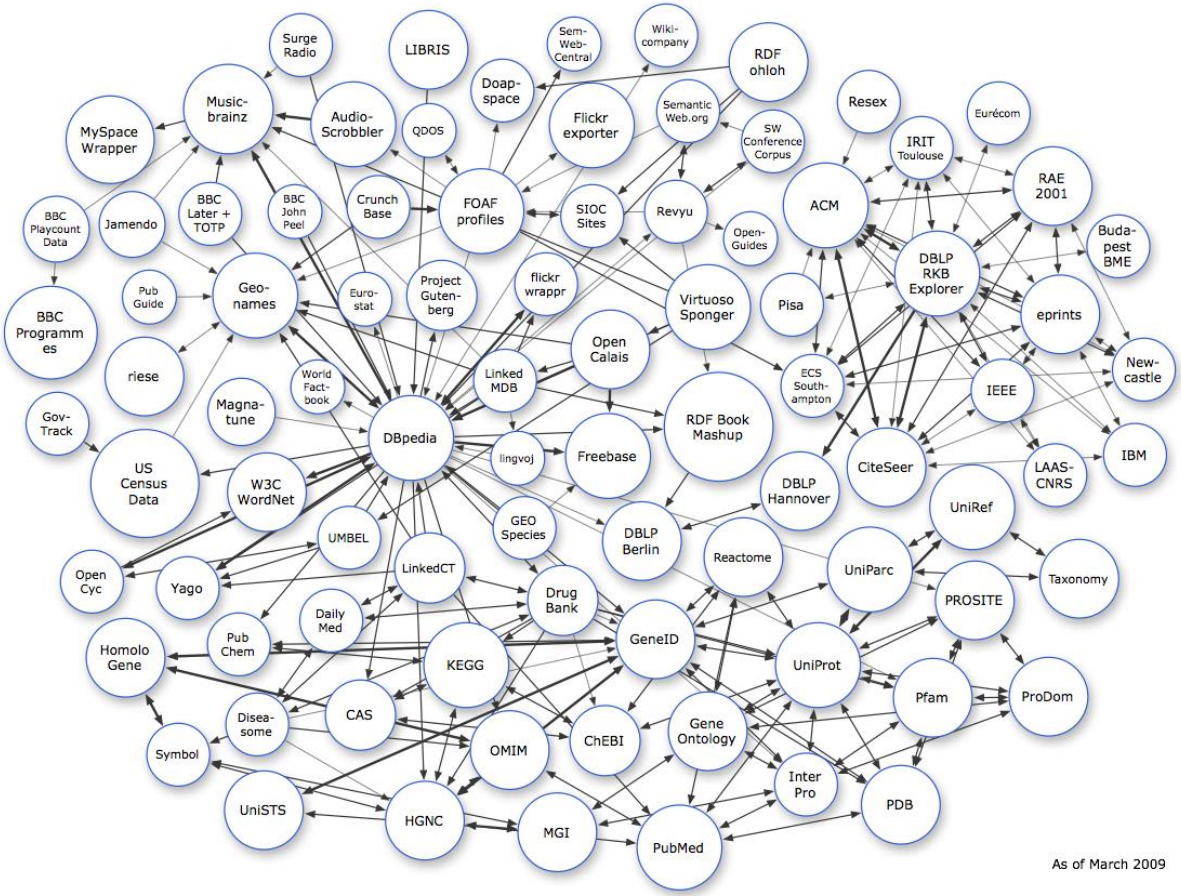
Web Data Annotating



http://www.ontoprise.de/

LOD Cloud March 2009

LINKINGOPENDATA
W3C SWEO Community Project



Linked Data, http://linkeddata.org/ (last accessed on 18.03.2009)

Data Linking on the Web

- **Linked Open Data statistics:**
  - **data sets: 121**
  - **total number of triples: 13.112.409.691**
  - **total number of links between data sets: 142.605.717**

- Statistics available at (last accessed on 04.02.2010):
  - http://esw.w3.org/topic/TaskForces/CommunityProjects/LinkingOpenData/DataSets/Statistics
  - http://esw.w3.org/topic/TaskForces/CommunityProjects/LinkingOpenData/DataSets/LinkStatistics

Data linking on the Web principles

- Use URIs as names for things
  - anything, not just documents
  - you are not your homepage
  - information resources and non-information resources
- Use HTTP URIs
  - globally unique names, distributed ownership
  - allows people to look up those names
- Provide useful information in RDF
  - when someone looks up a URI
- Include RDF links to other URIs
  - to enable discovery of related information

DBpedia

- DBpedia is a community effort to:
  - Extract structured information from Wikipedia
  - Make the information available on the Web under an open license
  - Interlink the DBpedia dataset with other open datasets on the Web
- DBpedia is one of the central interlinking-hubs of the emerging Web of Data

Content on this slide adapted from Anja Jentzsch and Chris Bizer

The DBpedia Dataset

- 91 languages
- Data about 2.9 million “things”. Includes for example:
  - 282.000 persons
  - 339.000 places
  - 119.00 organizations
  - 130.000 species
  - 88.000 music albums
  - 44.000 films
  - 19.000 books
- Altogether 479 million pieces of information (RDF triples)
  - 807.000 links to images
  - 3.840.000 links to external web pages
  - 4.878.100 data links into external RDF datasets

Content on this slide adapted from Anja Jentzsch and Chris Bizer

LinkedCT

- LinkedCT is the Linked Data version of ClinicalTrials.org containing data about clinical trials.

- Total number of triples:

  6,998,851
- Number of Trials:

  61,920
- RDF links to other data sources:

  177,975
- Links to other datasets:
  - DBpedia and YAGO(from intervention and conditions)
  - GeoNames (from locations)
  - Bio2RDF.org's PubMed (from references)

Content on this slide adapted from Chris Bizer

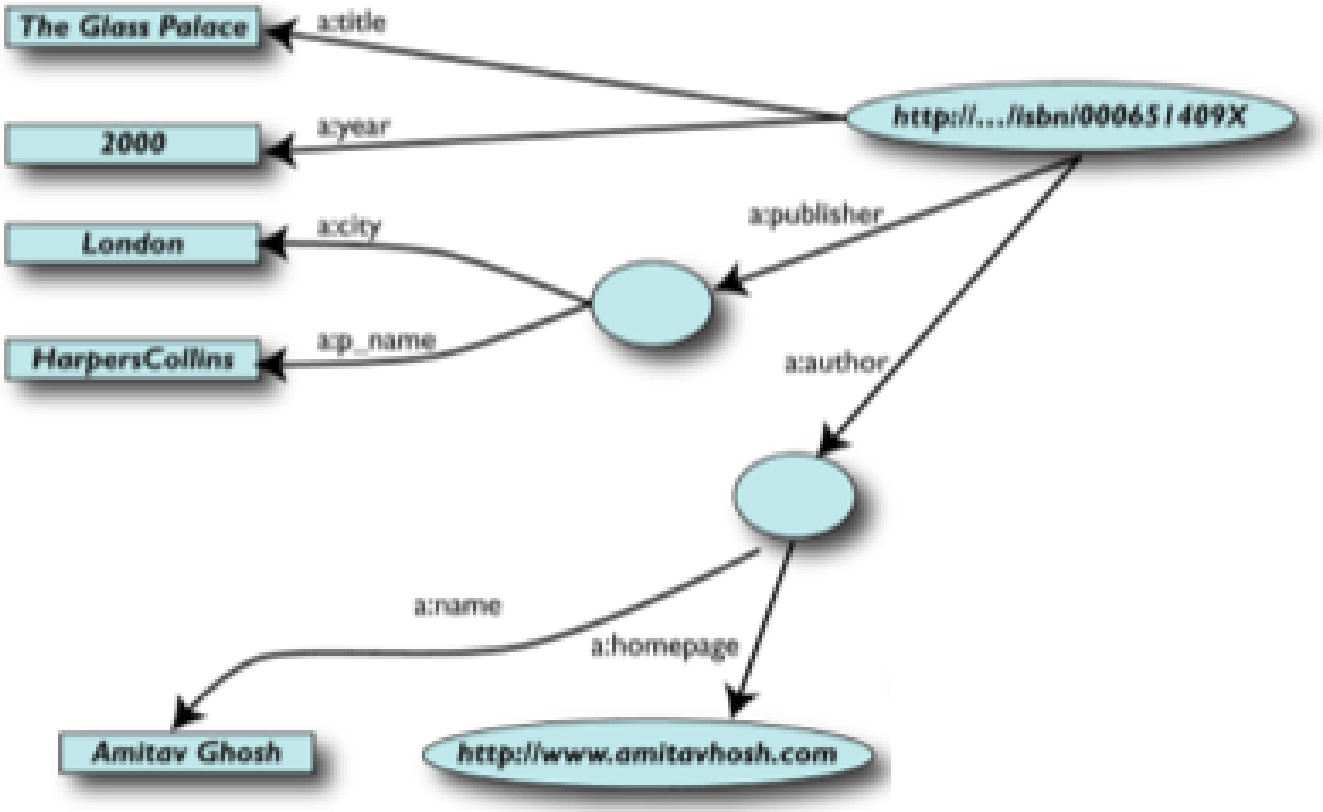
Data integration over the Web

- Data integration involves combining data residing in different sources and providing user with a unified view of these data
- Data integration over the Web can be implemented as follows:
    1. **Export the data sets to be integrated as RDF graphs**
    2. **Merge identical resources (i.e. resources having the same URI) from different data sets**
    3. **Start making queries on the integrated data, queries that were not possible on the individual data sets.**

Data integration over the Web

1. **Export first data set as RDF graph**

   For example the following RDF graph contains information about book “The Glass Palace” by Amitav Ghosh

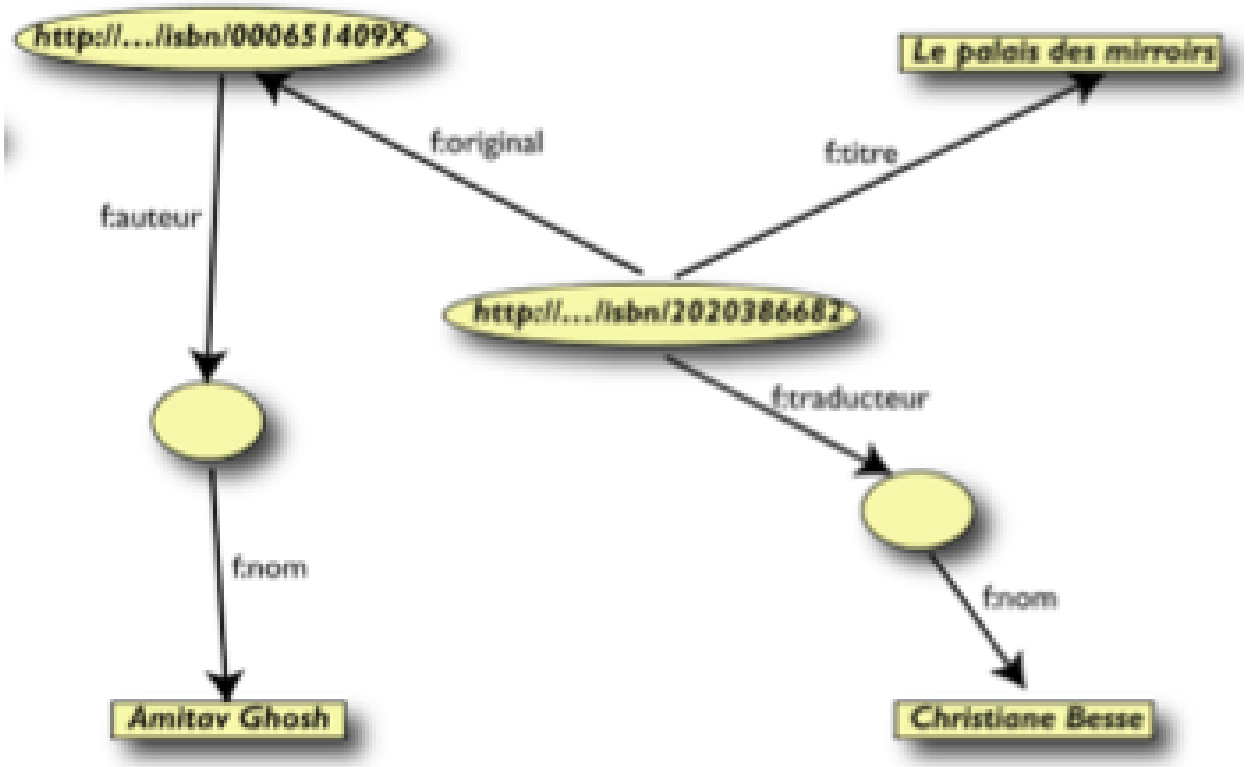


http://www.w3.org/People/Ivan/CorePresentations/SWTutorial/Slides.pdf

Data integration over the Web

1. **Export second data set as RDF graph**

   Information about the same book but in French this time is modeled in RDF graph below



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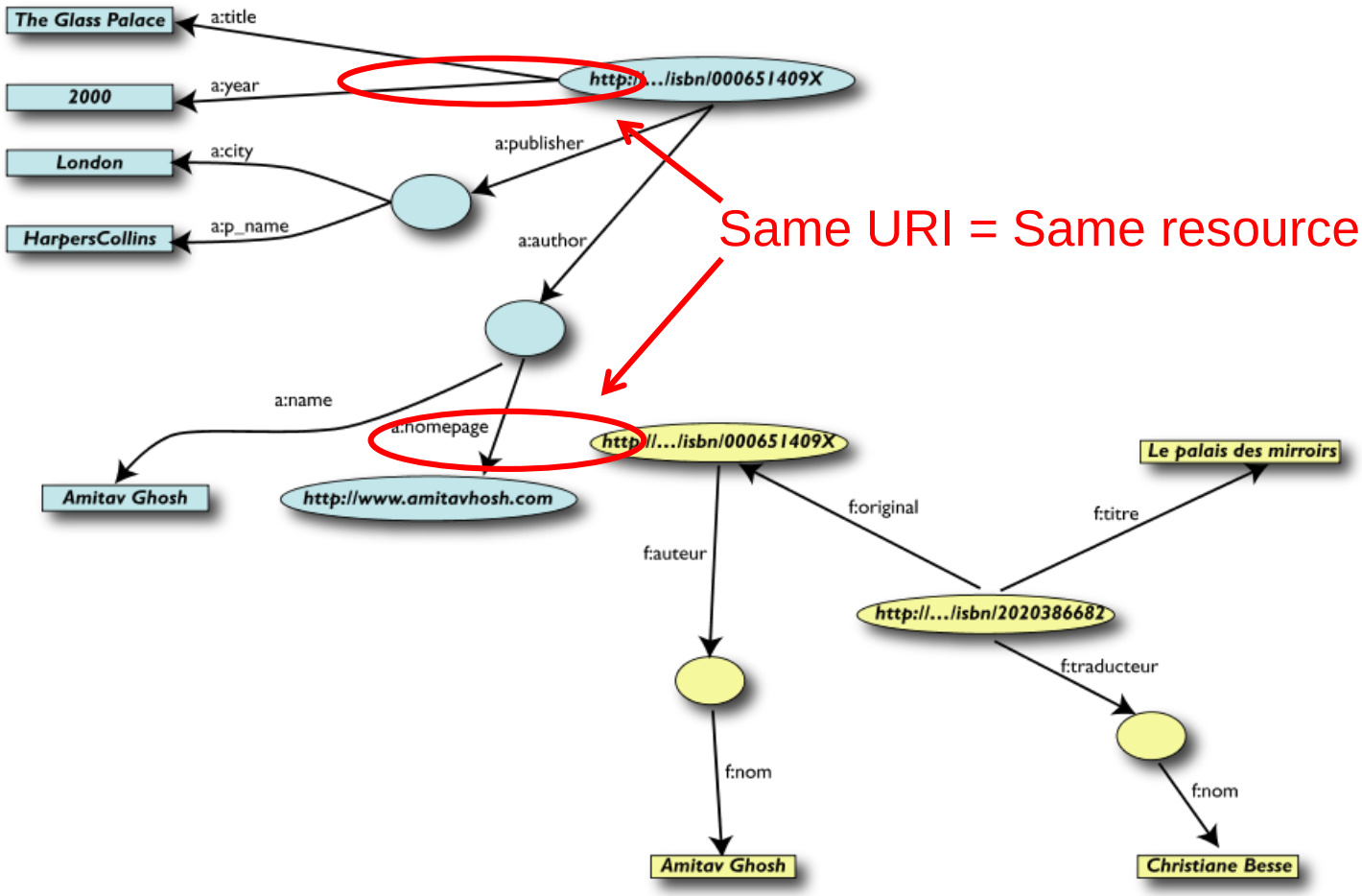
Data Integration over the Web

2. Merge identical resources (i.e. resources having the same URI) from different data sets



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Data integration over the Web

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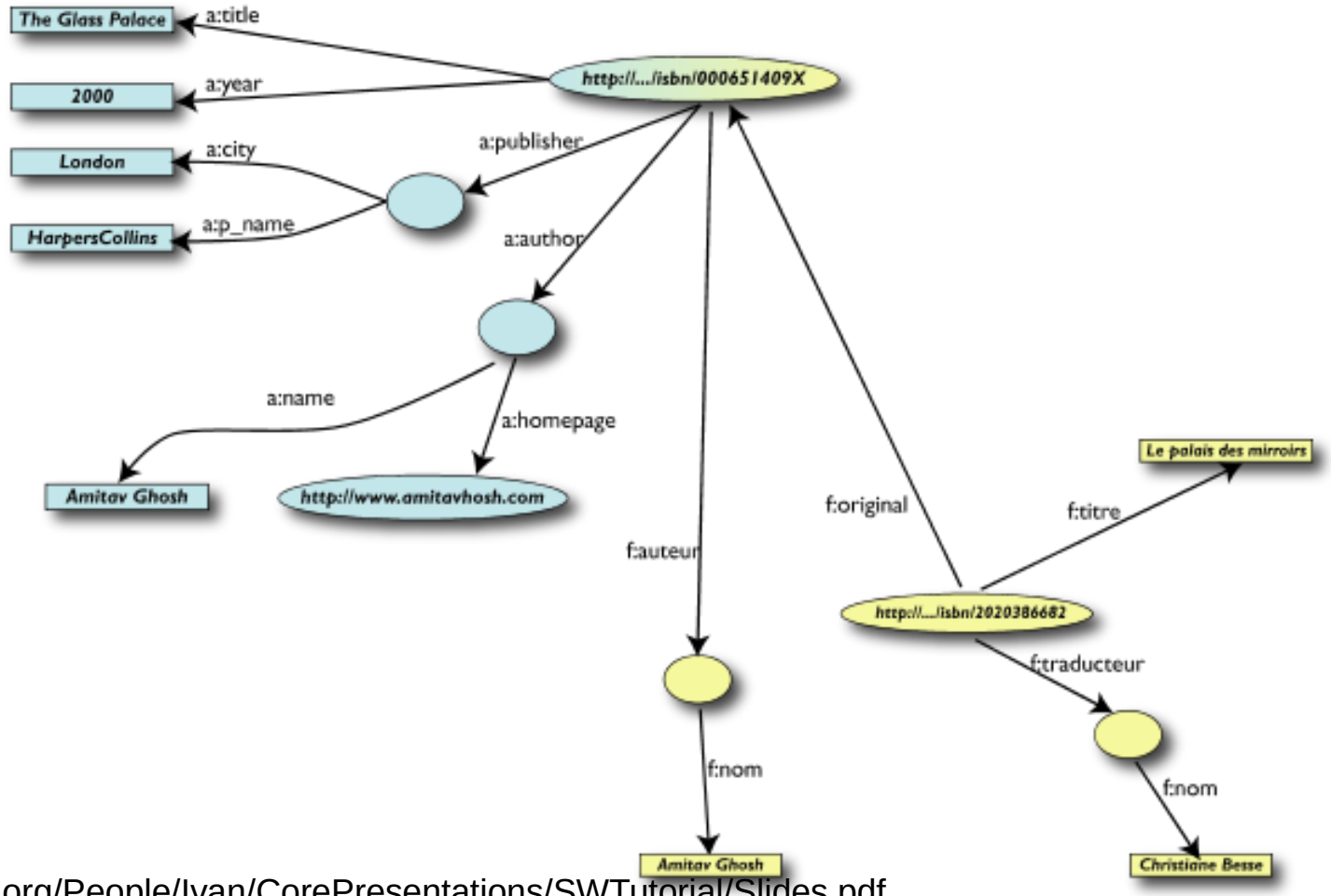


http://www.w3.org/People/Ivan/CorePresentations/SWTutorial/Slides.pdf

Data integration over the Web

3. **Start making queries on the integrated data**

- A user of the second dataset may ask queries like*: "give me the title of the original book"*
- This information is not in the second dataset
- This information can be however retrieved from the integrated dataset, in which the second dataset was connected with the the first dataset

SEMANTIC WEB – ARCHITECTURE AND LANGUAGES

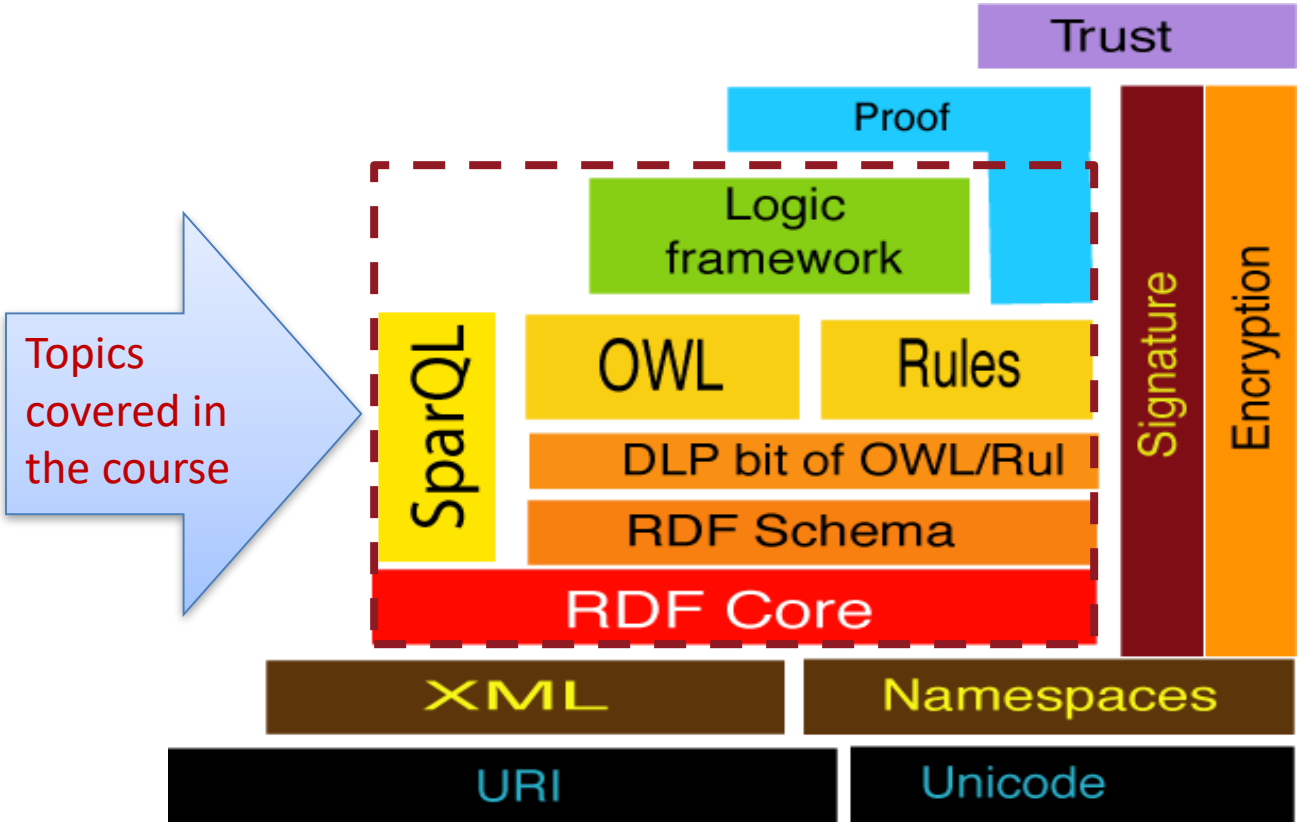
Web Architecture

- Things are denoted by URIs
- Use them to denote things
- Serve useful information at them
- Dereference them

Semantic Web Architecture

- Give important concepts URIs
- Each URI identifies one concept
- Share these symbols between many languages
- Support URI lookup

Semantic Web - Data



URI and XML

- Uniform Resource Identifier (URI) is the dual of URL on Semantic Web
  - it’s purpose is to indentify resources
- eXtensible Markup Language (XML) is a markup language used to structure information
  - fundament of data representation on the Semantic Web
  - tags do not convey semantic information

RDF and OWL

- Resource Description Framework (RDF) is the dual of HTML in the Semantic Web
  - simple way to describe resources on the Web
  - sort of simple ontology language (RDF-S)
  - based on triples (subject; predicate; object)
  - serialization is XML based
- Ontology Web Language (OWL) a layered language based on DL
  - more complex ontology language
  - overcome some RDF(S) limitations

SPARQL and Rule languages

- SPARQL
  - Query language for RDF triples
  - A protocol for querying RDF data over the Web
- Rule languages (e.g. SWRL)
  - Extend basic predicates in ontology languages with proprietary predicates
  - Based on different logics
    - Description Logic
    - Logic Programming

SEMANTIC WEB - DATA

Semantic Web - Data

- URIs are used to identify **resources**, not just things that exists on the Web, e.g. *Sir Tim Berners-Lee*
- RDF is used to make statements about resources in the form of **triples**

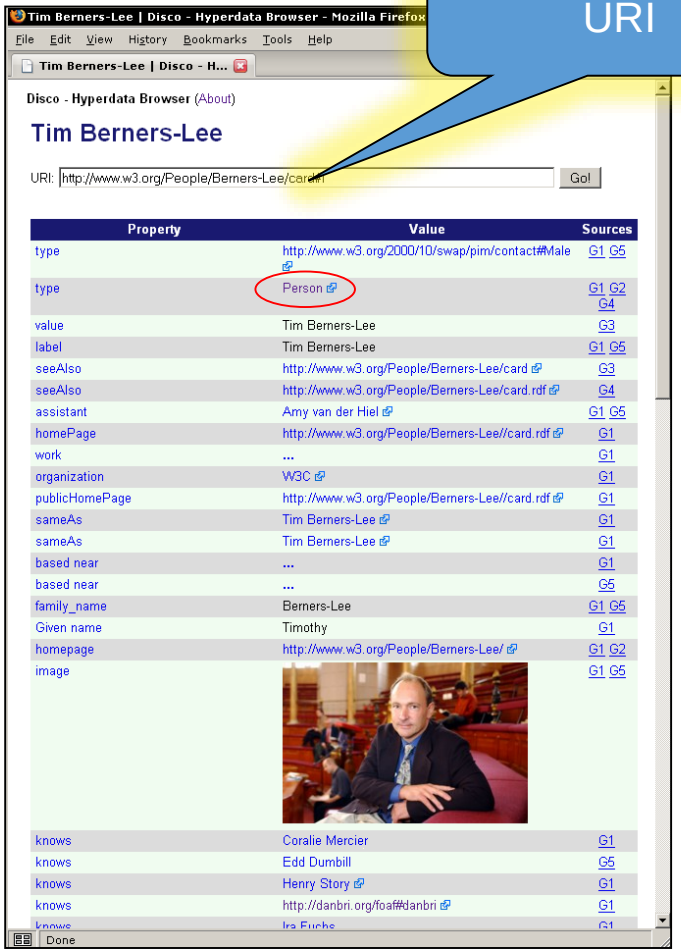
  <entity, property, value>
- With RDFS, resources can belong to **classes** (*my Mercedes belongs to the class of cars*) and classes can be **subclasses** or **superclasses** of other classes (*vehicles are a superclass of cars, cabriolets are a subclass of cars*)

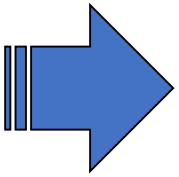
Semantic Web - Data

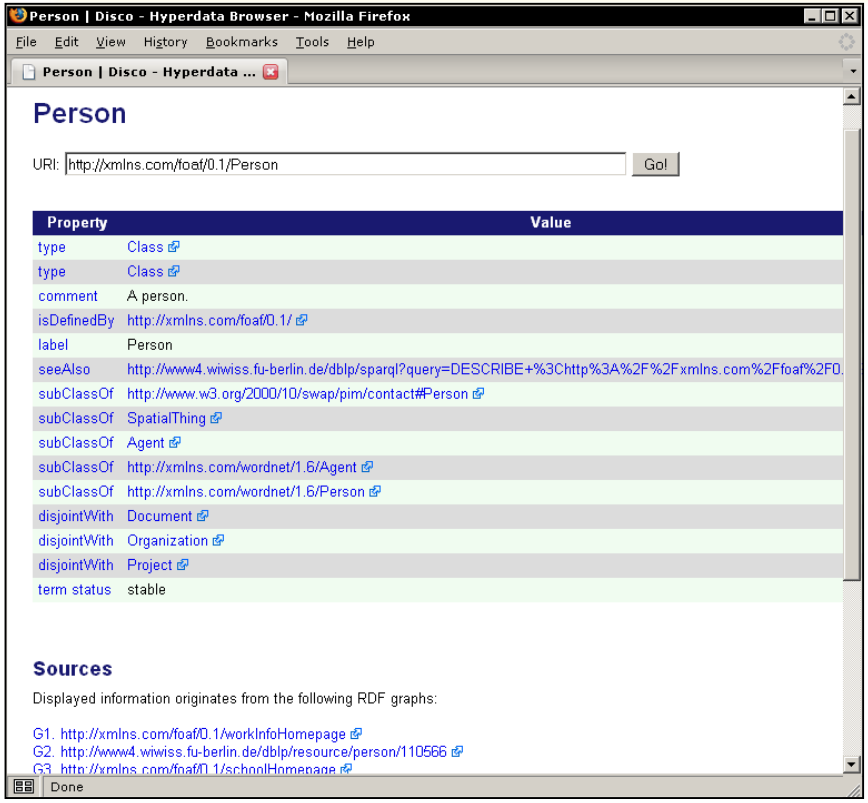
Dereferencable URI

Disco Hyperdata Browser

navigating the Semantic Web as an unbound set of data sources







KIM platform

The KIM platform provides a novel infrastructure and services for:

- automatic semantic annotation,
- indexing,
- retrieval of unstructured and semi-structured content.

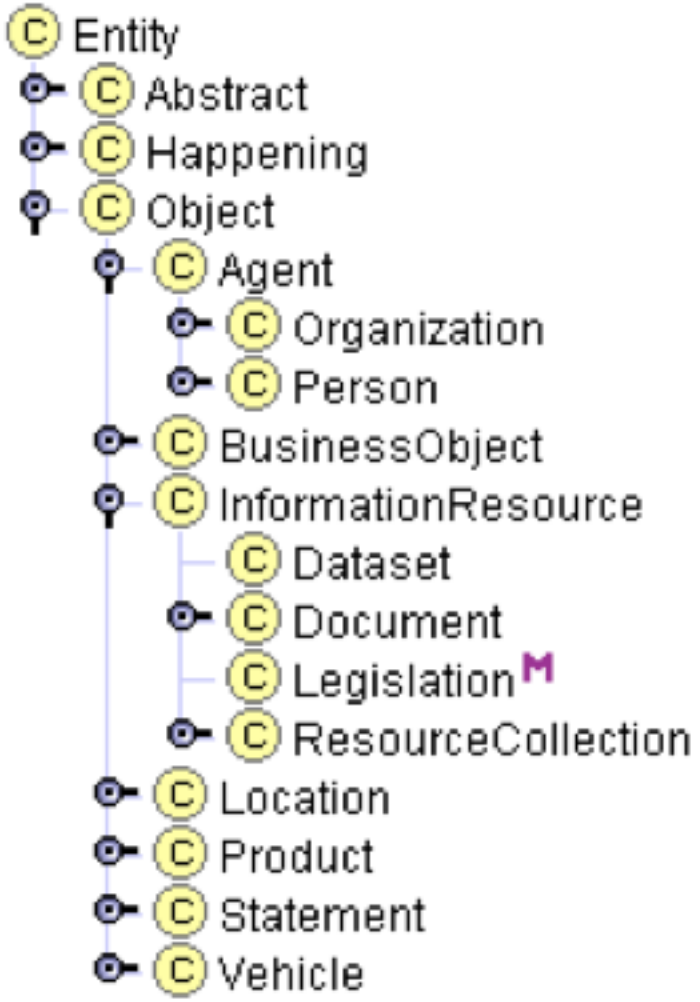
KIM Constituents

The KIM Platform includes:

- Ontologies (PROTON + KIMSO + KIMLO) and KIM World KB
- KIM Server – with a set of APIs for remote access and integration
- Front-ends: Web-UI and plug-in for Internet Explorer.

KIM Ontology (KIMO)

- light-weight upper-level ontology
- 250 NE classes
- 100 relations and attributes:
- covers mostly NE classes, and ignores general concepts
- includes classes representing lexical resources



KIM KB

- KIM KB consists of above 80,000 entities (50,000 locations, 8,400 organization instances, etc.)

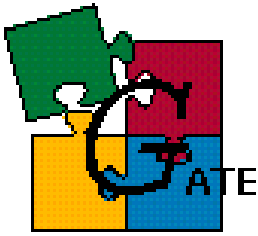
- Each location has geographic coordinates and several aliases (usually including English, French, Spanish, and sometimes the local transcription of the location name) as well as co-positioning relations (e.g. **subRegionOf.)**

- The organizations have **locatedIn** relations to the corresponding Country instances. The additionally imported information about the companies consists of short description, URL, reference to an industry sector, reported sales, net income,and number of employees.

KIM is Based On…

KIM is based on the following open-source platforms:

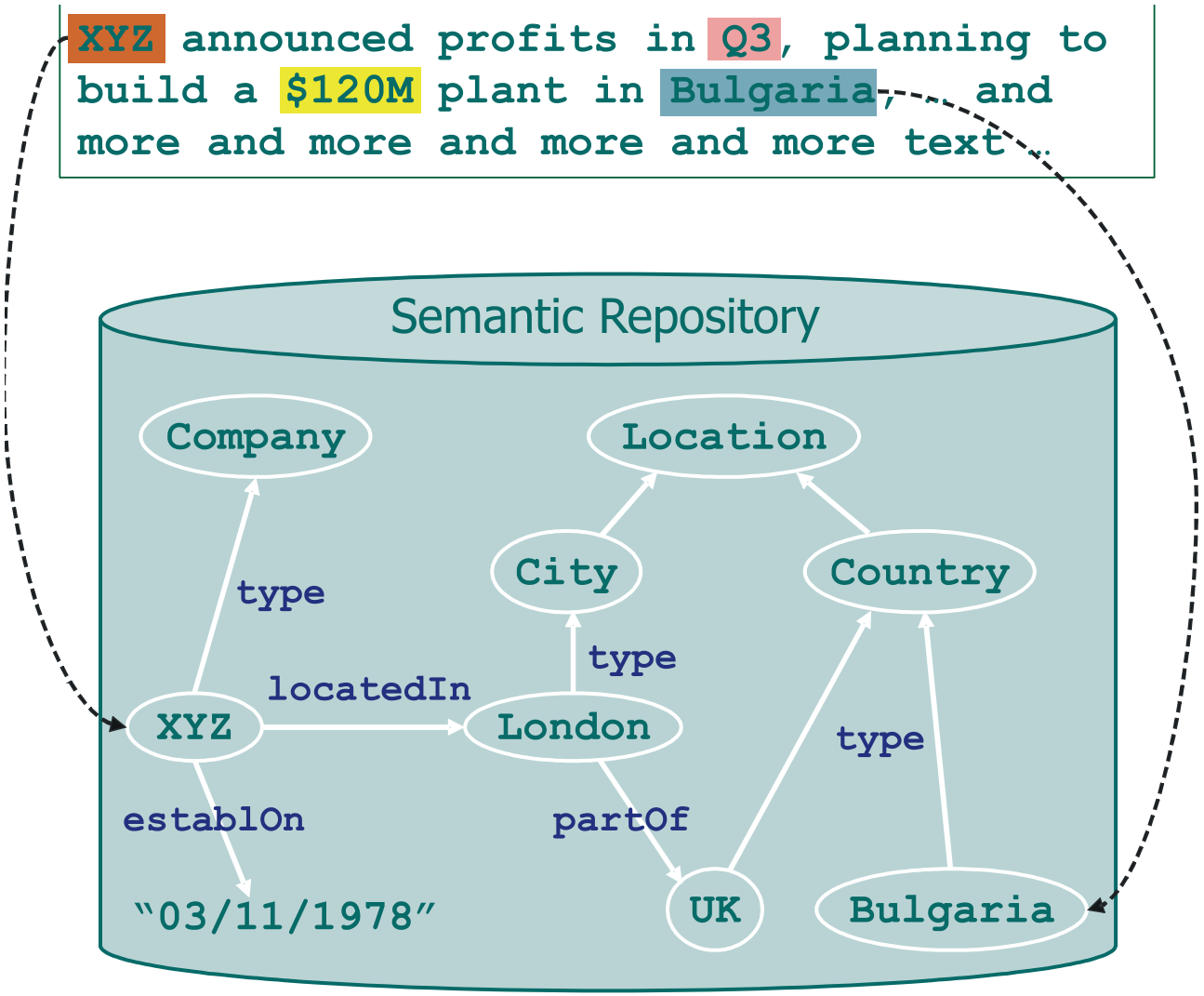
- GATE – the most popular NLP and IE platform in the world, developed at the University of Sheffield. Ontotext is its biggest co-developer. www.gate.ac.uk and www.ontotext.com/gate



- OWLIM – OWL repository, compliant with Sesame RDF database from Aduna B.V. **www.ontotext.com/owlim**

- Lucene – an open-source IR engine by Apache. jakarta.apache.org/lucene/

KIM Platform – Semantic Annotation

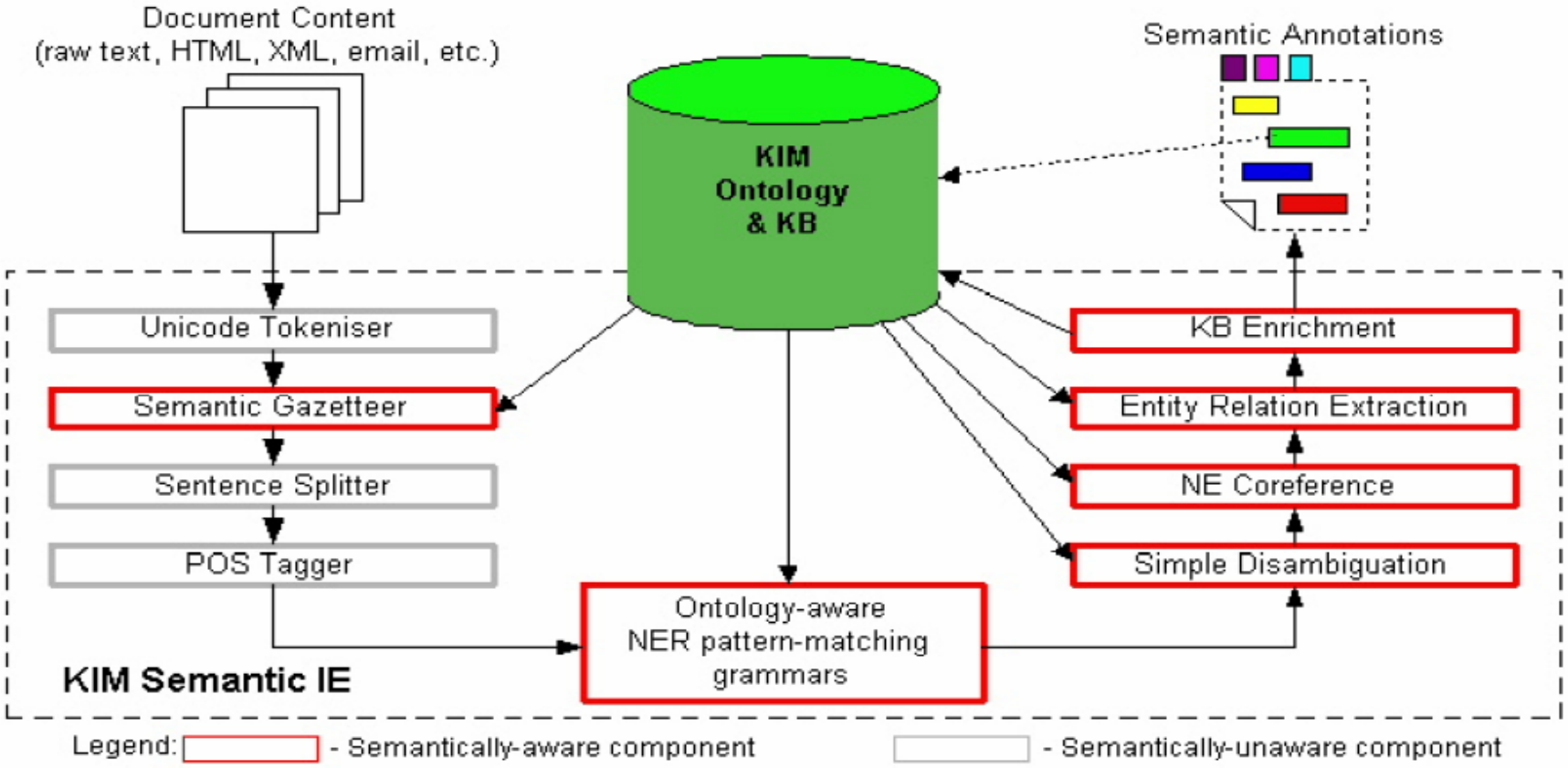


KIM platform – Semantic Annotation

- The automatic semantic annotation is seen as a named-entity recognition (NER) and annotation process.
- The traditional flat NE type sets consist of several general types (such as Organization, Person, Date, Location, Percent, Money). In KIM the NE type is specified by reference to an ontology.
- The semantic descriptions of entities and relations between them are kept in a knowledge base (KB) encoded in the KIM ontology and residing in the same semantic repository. Thus KIM provides for each entity reference in the text (i) a link (URI) to the most specific class in the ontology and (ii) a link to the specific instance in the KB. Each extracted NE is linked to its specific type information (thus Arabian Sea would be identified as **Sea**, instead of the traditional – **Location).**

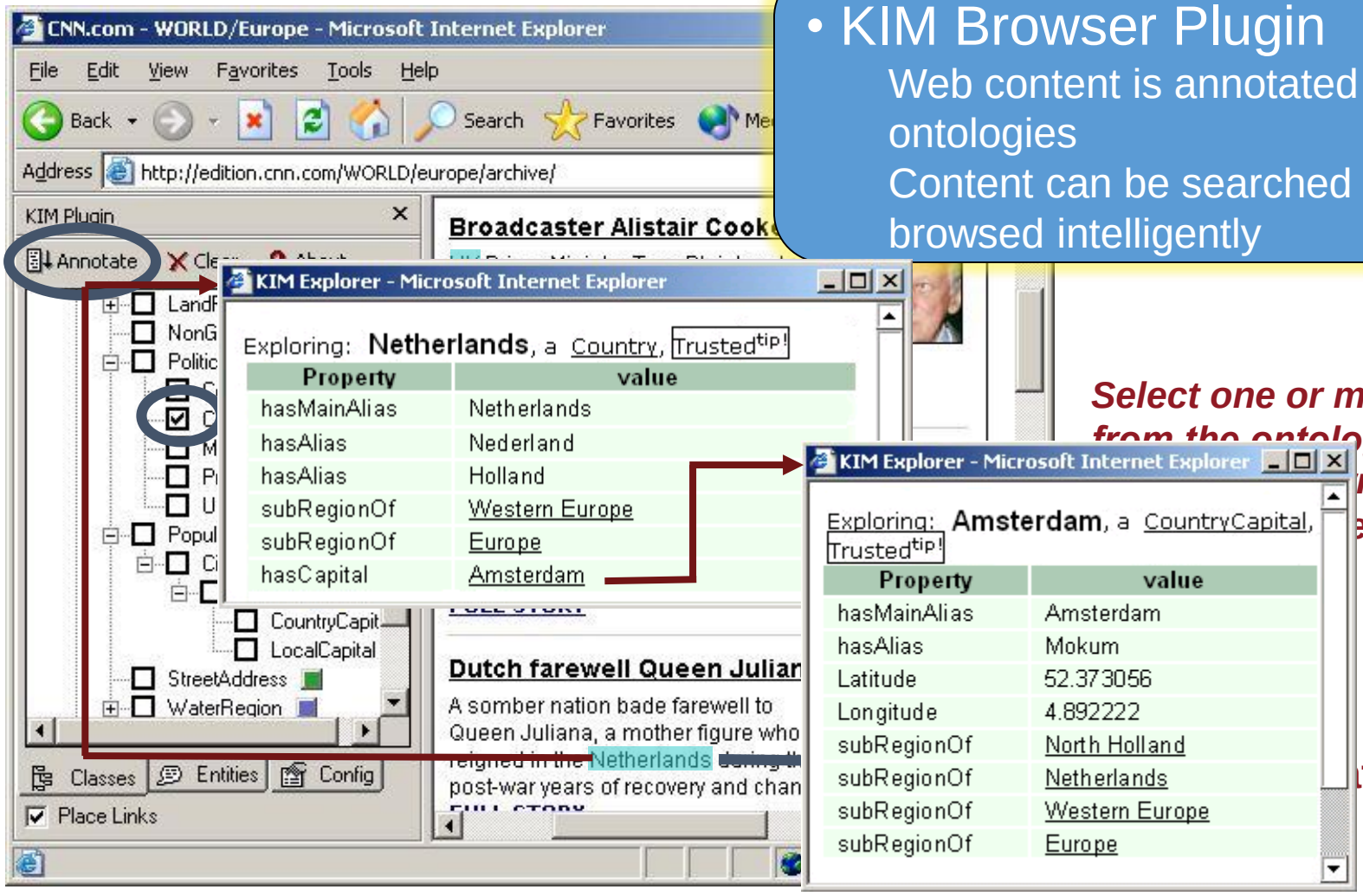
KIM platform – Information Extraction

- KIM performs IE based on an ontology and a massive knowledge base.



KIM platform - Browser Plug-in

- KIM Browser Plugin
  - Web content is annotated using ontologies
  - Content can be searched and browsed intelligently



Select one or more concepts from the ontology…

…rently loaded …e Annotation

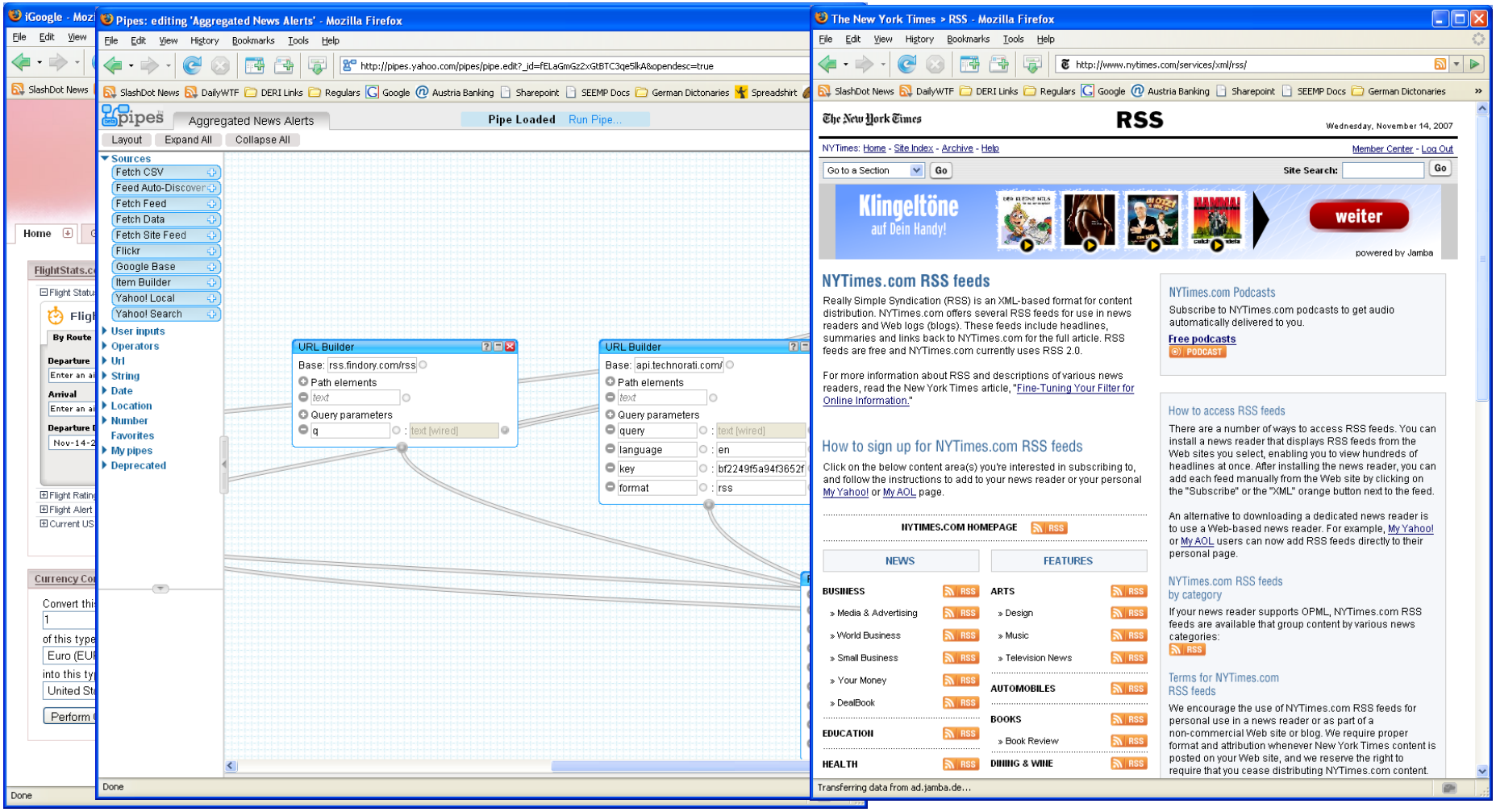
…ted Content

SEMANTIC WEB - PROCESSES

Processes

- The Web is moving from static data to dynamic functionality
  - Web services: a piece of software available over the Internet, using standardized XML messaging systems over the SOAP protocol
  - Mashups: The compounding of two or more pieces of web functionality to create powerful web applications

Semantic Web - Processes



Semantic Web - Processes

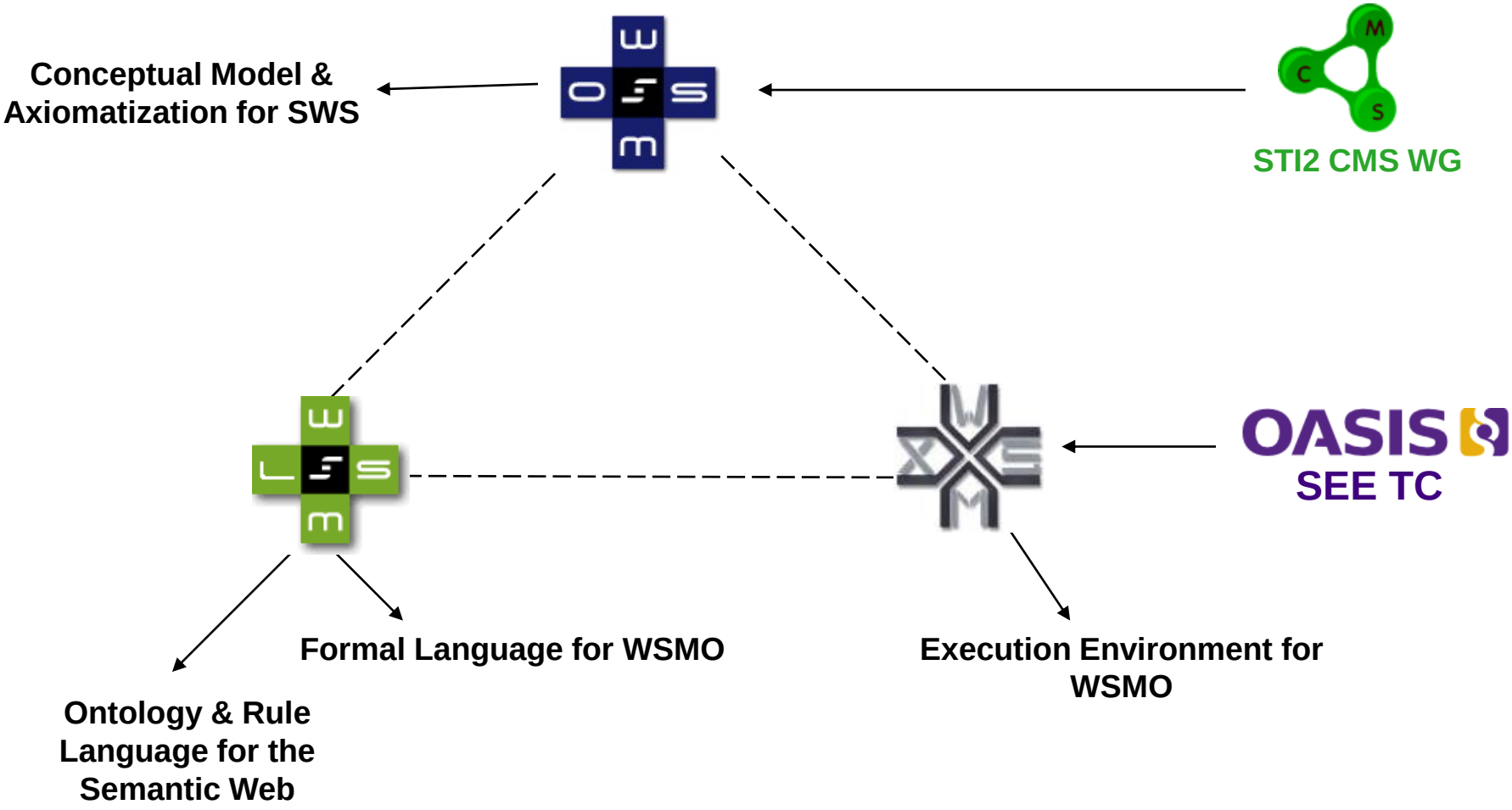
- Web services and mashups are limited by their syntactic nature
- As the amount of services on the Web increases it will be harder to find Web services in order to use them in mashups
- The current amount of human effort required to build applications is not sustainable at a Web scale

Semantic Web - Processes

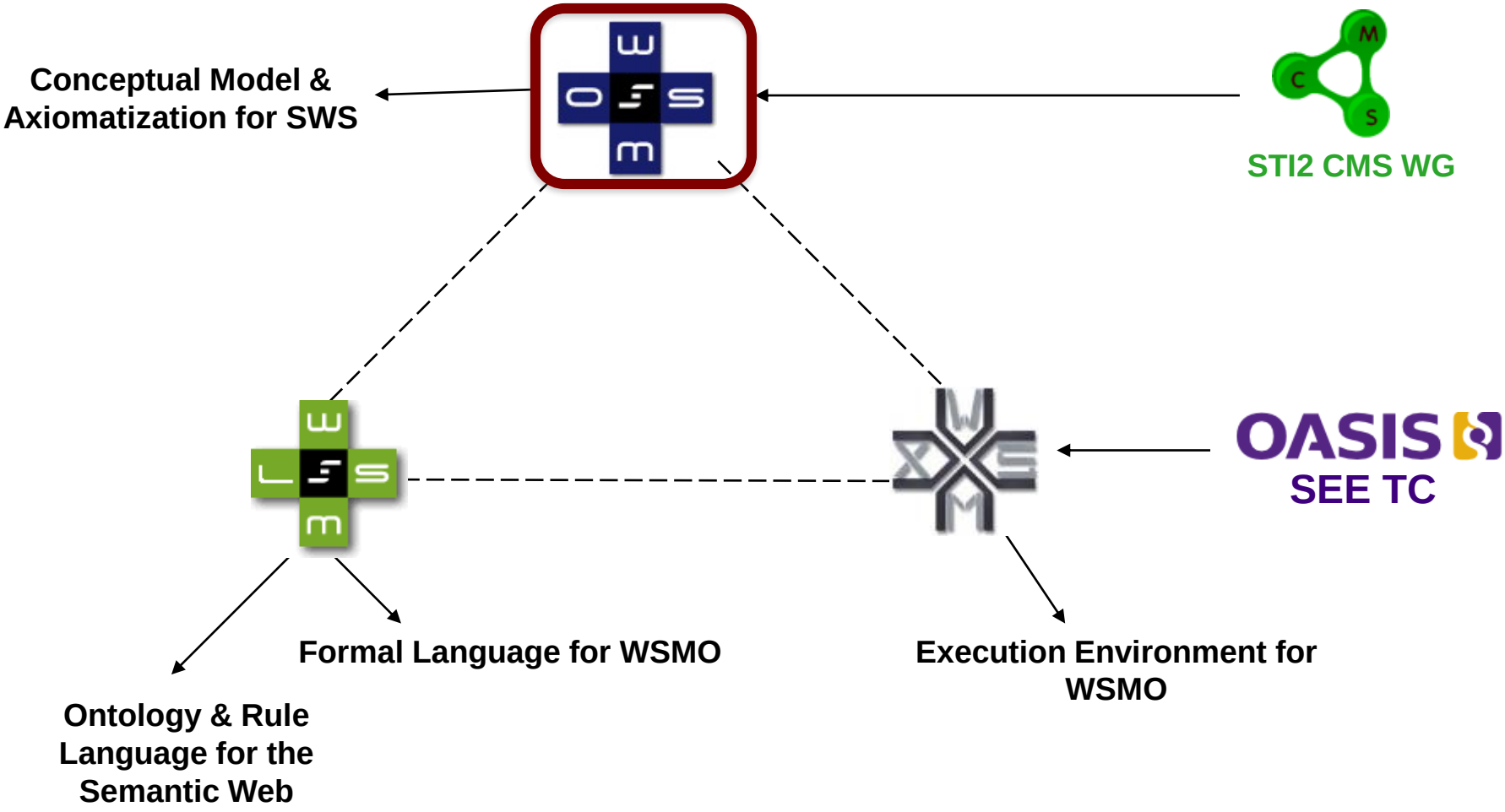
- The addition of semantics to form Semantic Web Services and Semantically Enabled Service-oriented Architectures can enable the automation of many of these currently human intensive tasks
  - Service Discovery, Adaptation, Ranking, Mediation, Invocation

- Frameworks:
  - **OWL-S:** WS Description Ontology (Profile, Service Model, Grounding)
  - **WSMO:** Ontologies, Goals, Web Services, Mediators
  - **SWSF:** Process-based Description Model & Language for WS
  - **SAWSDL (WSDL-S):** Semantic annotation of WSDL descriptions

The WSMO Approach

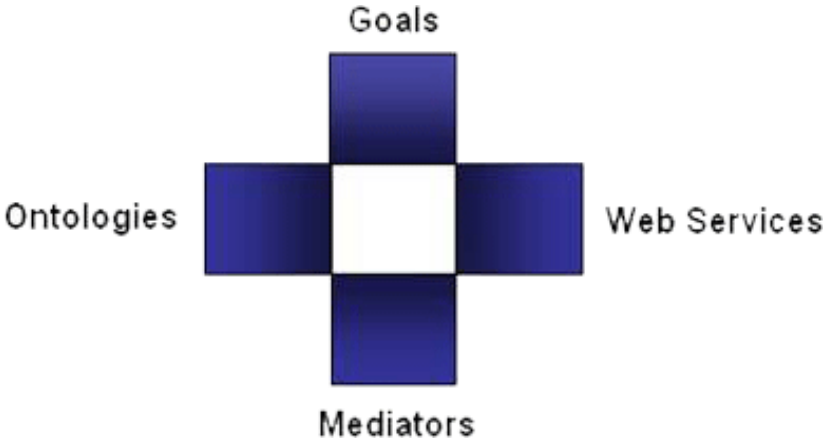


Web Service Modeling Ontology (WSMO)



WSMO

Objectives that a client wants to achieve by using Web Services



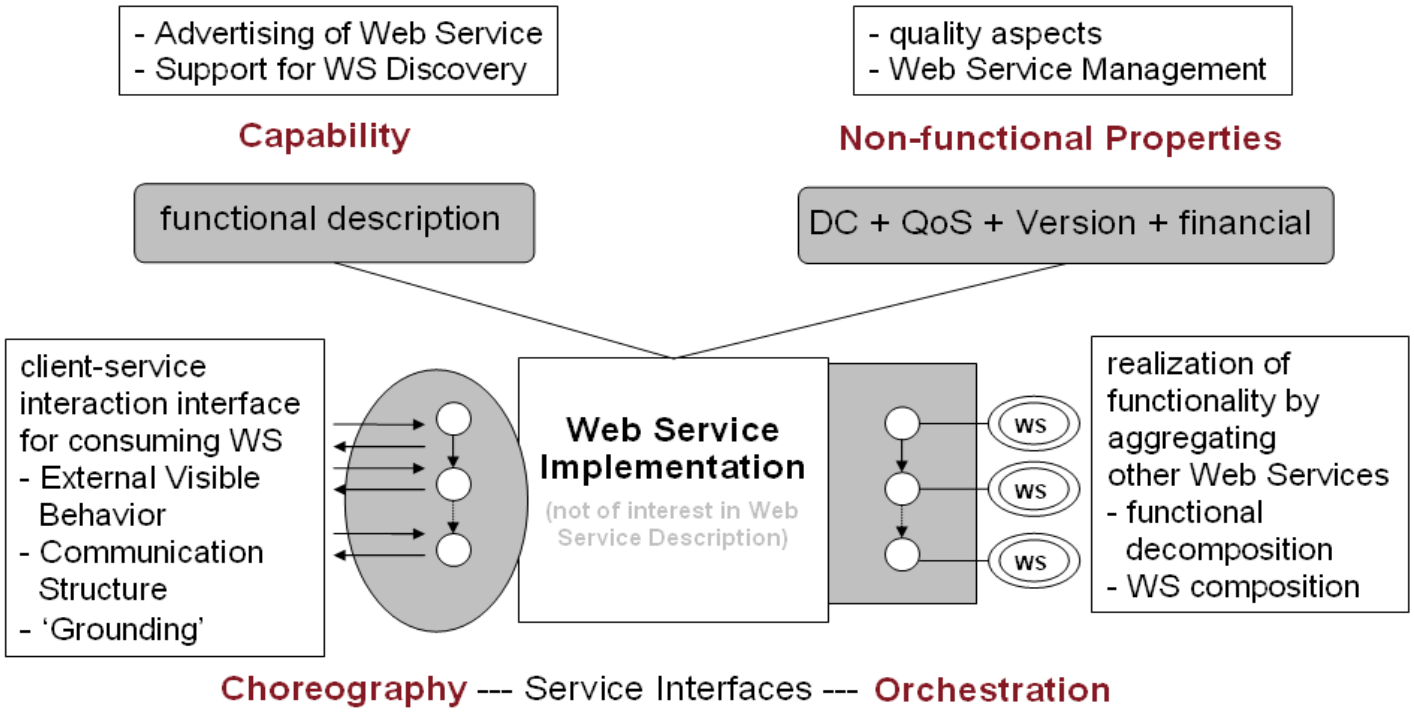
Provide the formally specified terminology of the information used by all other components

Semantic description of Web Services:
- **Capability** *(functional)*
- **Interfaces** *(usage)*

Connectors between components with mediation facilities for handling heterogeneities

WSMO Top Elements

- **Ontologies:**
  - In WSMO, Ontologies are the key to linking conceptual real-world semantics defined and agreed upon by communities of users
- **Web Services:**
  - In WSMO, Web service descriptions consist of non-functional, functional, and the behavioral aspects of a Web service

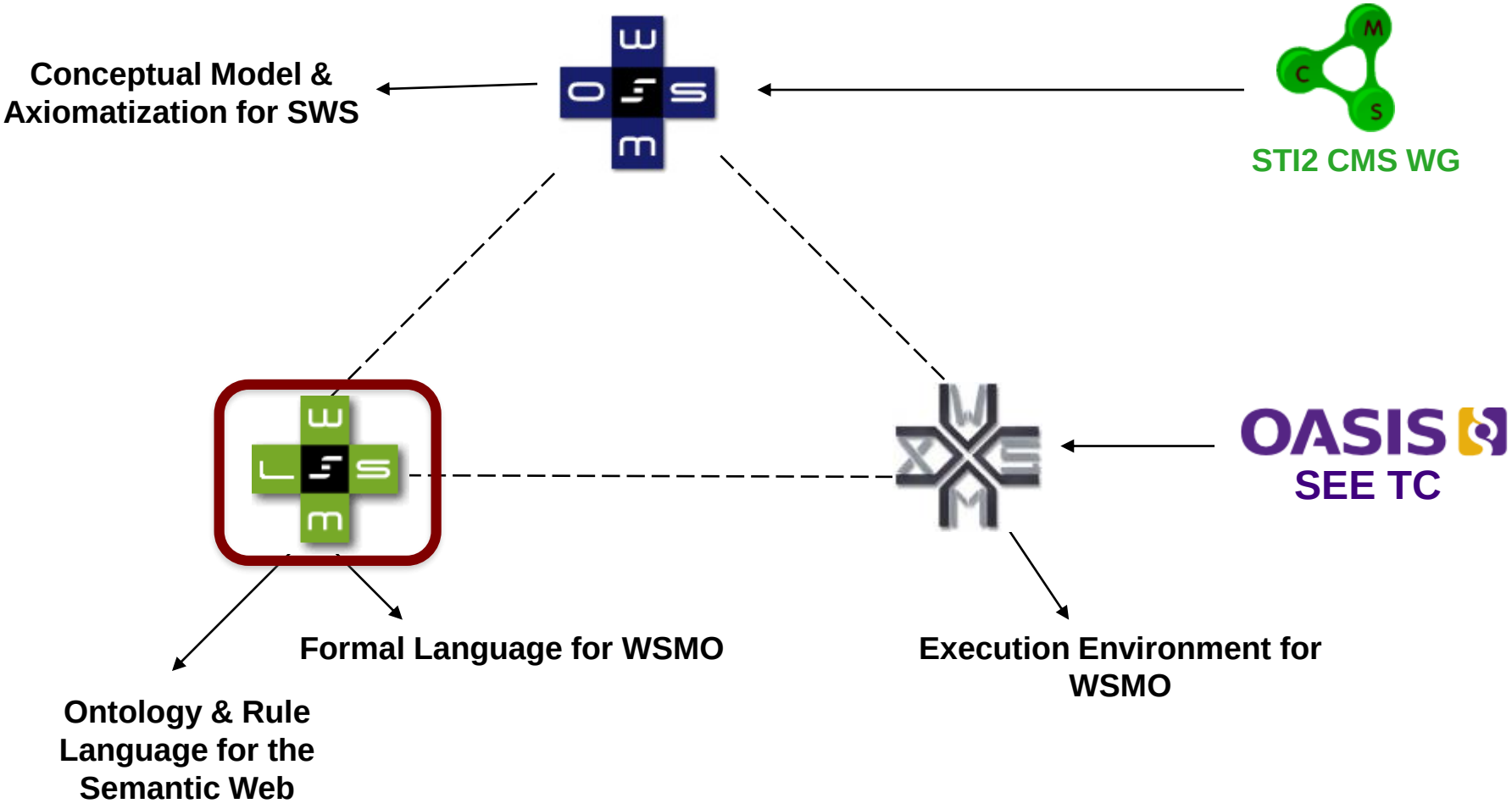


WSMO Top Elements (1)

- **Goals:**
  - Goals are representations of an objective for which fulfillment is sought through the execution of a Web service. Goals can be descriptions of Web services that would potentially satisfy the user desires

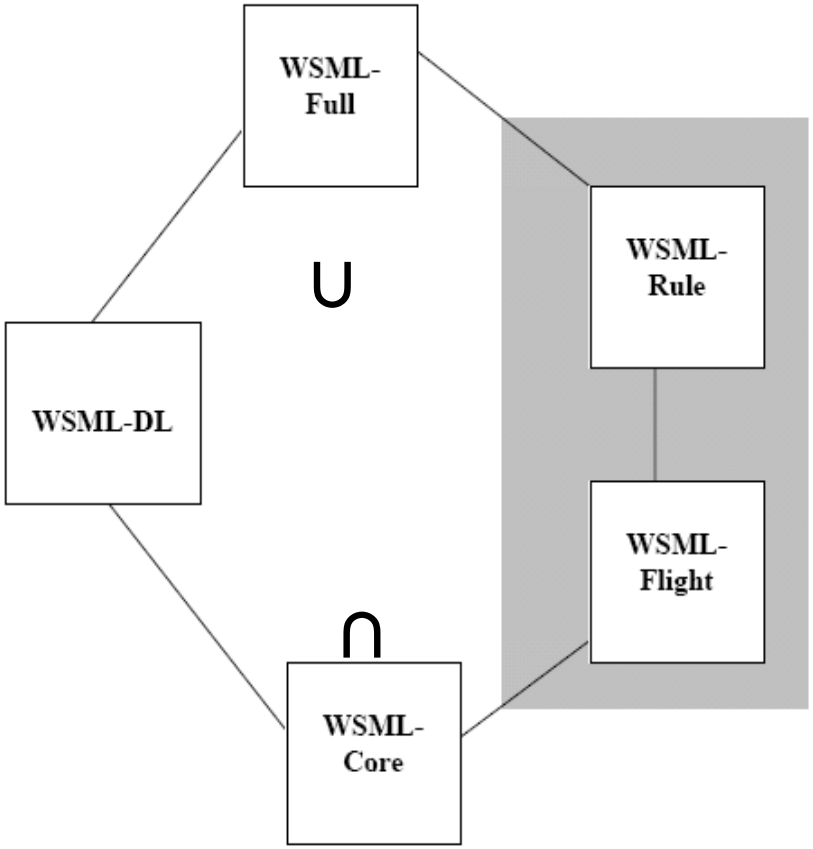
    Class goal **sub-Class** wsmoElement
    importsOntology **type** ontology
    usesMediator **type** {ooMediator, ggMediator}
    hasNonFunctionalProperties **type** nonFunctionalProperty
    requestsCapability **type** capability *multiplicity = single-valued*
    requestsInterface **type** interface
- **Mediators:**
  - In WSMO, heterogeneity problems are solved by mediators at various levels:
    - ***Data Level*** - mediate heterogeneous Data Sources
    - ***Protocol Level*** - mediate heterogeneous Communication Patterns
    - ***Process Level*** - mediate heterogeneous Business Processes

Web Service Modeling Language (WSML)

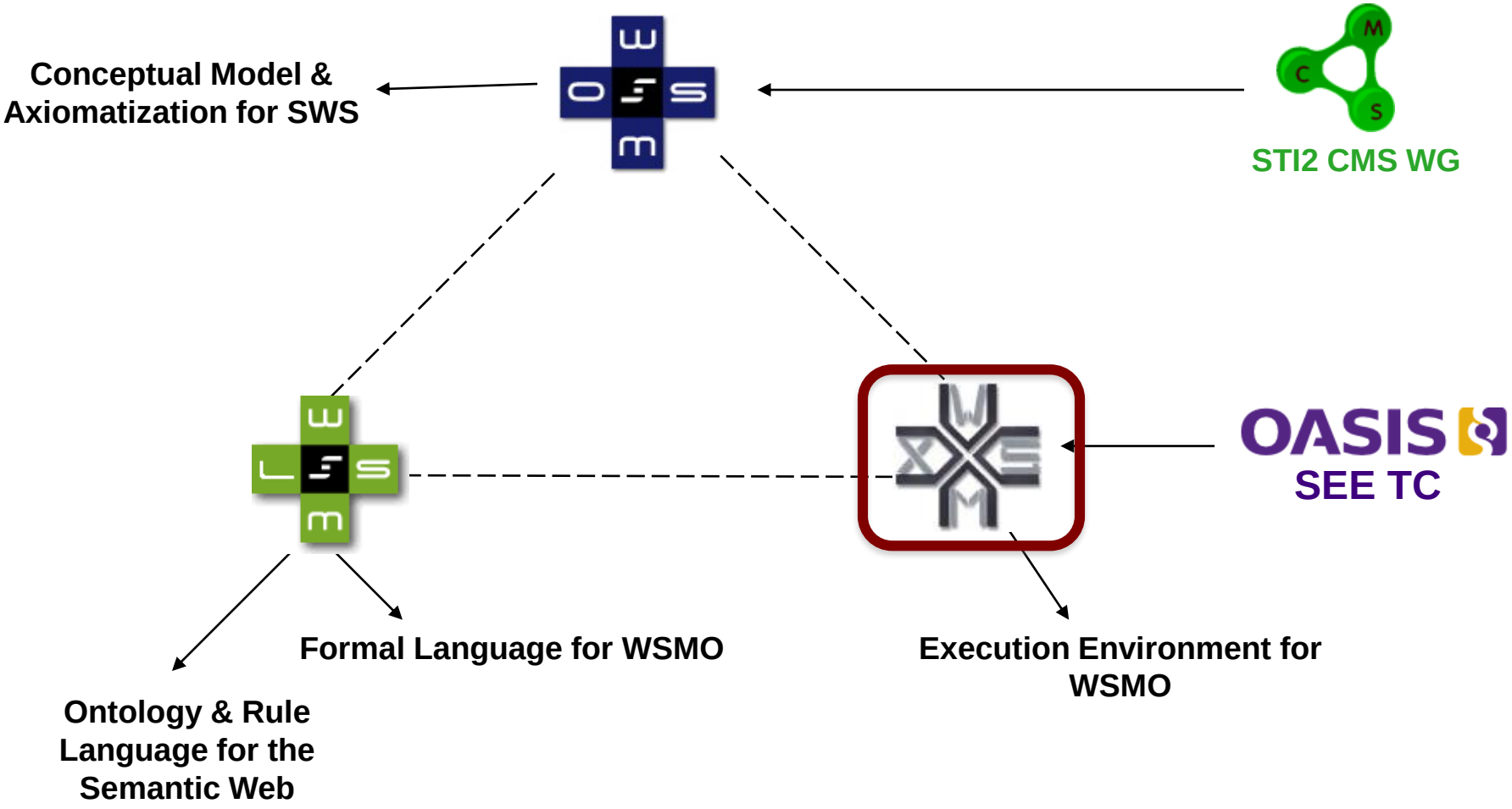


WSML Variants

- WSML Variants - allow users to make the trade-off between the provided expressivity and the implied complexity on a per-application basis



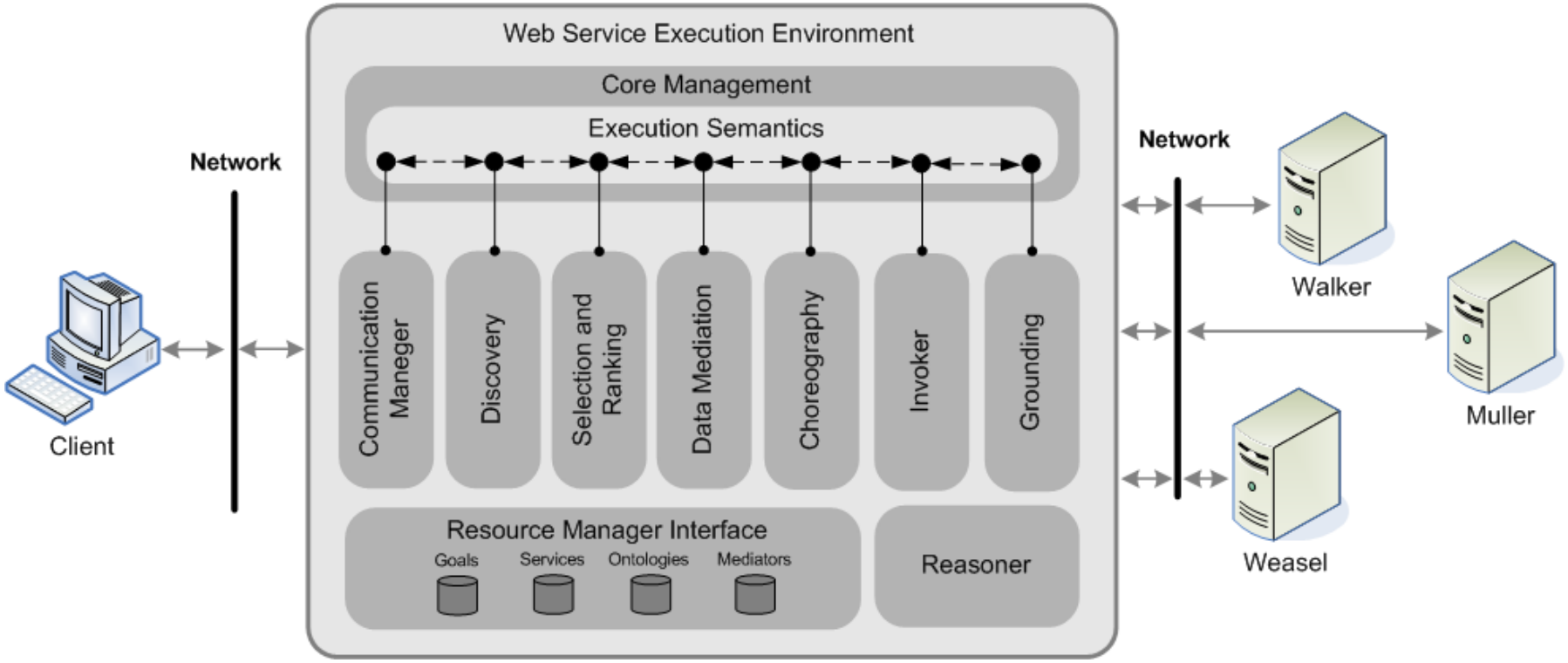
Web Service Execution Environment (WSMX)



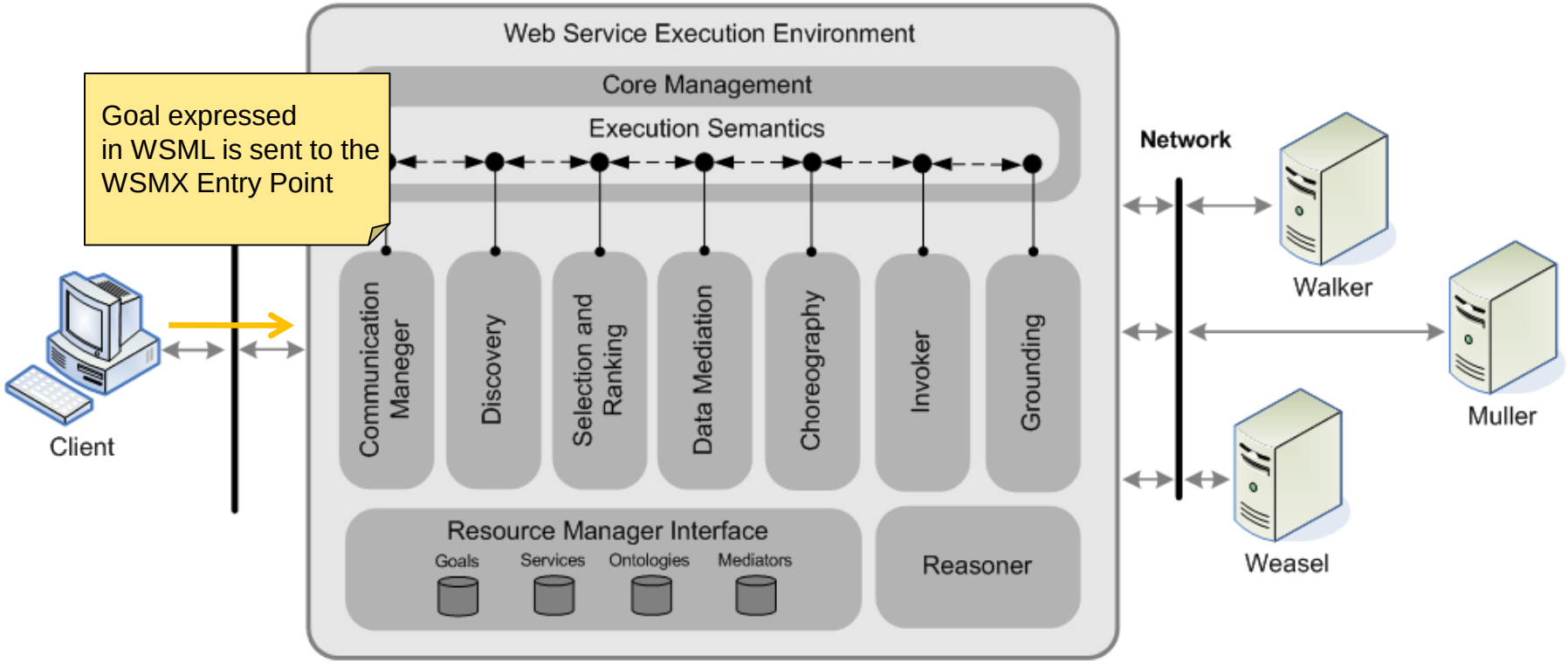
Web Service Execution Environment (WSMX)

- … is comprehensive software framework for runtime binding of service requesters and service providers,
- … interprets service requester's goal to
  - discover matching services,
  - select (if desired) the service that best fits,
  - provide data/process mediation (if required), and
  - make the service invocation,
- … is reference implementation for WSMO,
- … has a formal execution semantics, and
- … is service oriented, event-based and has pluggable architecture
  - Open source implementation available through Source Forge,
  - based on microkernel design using technologies such as JMX.

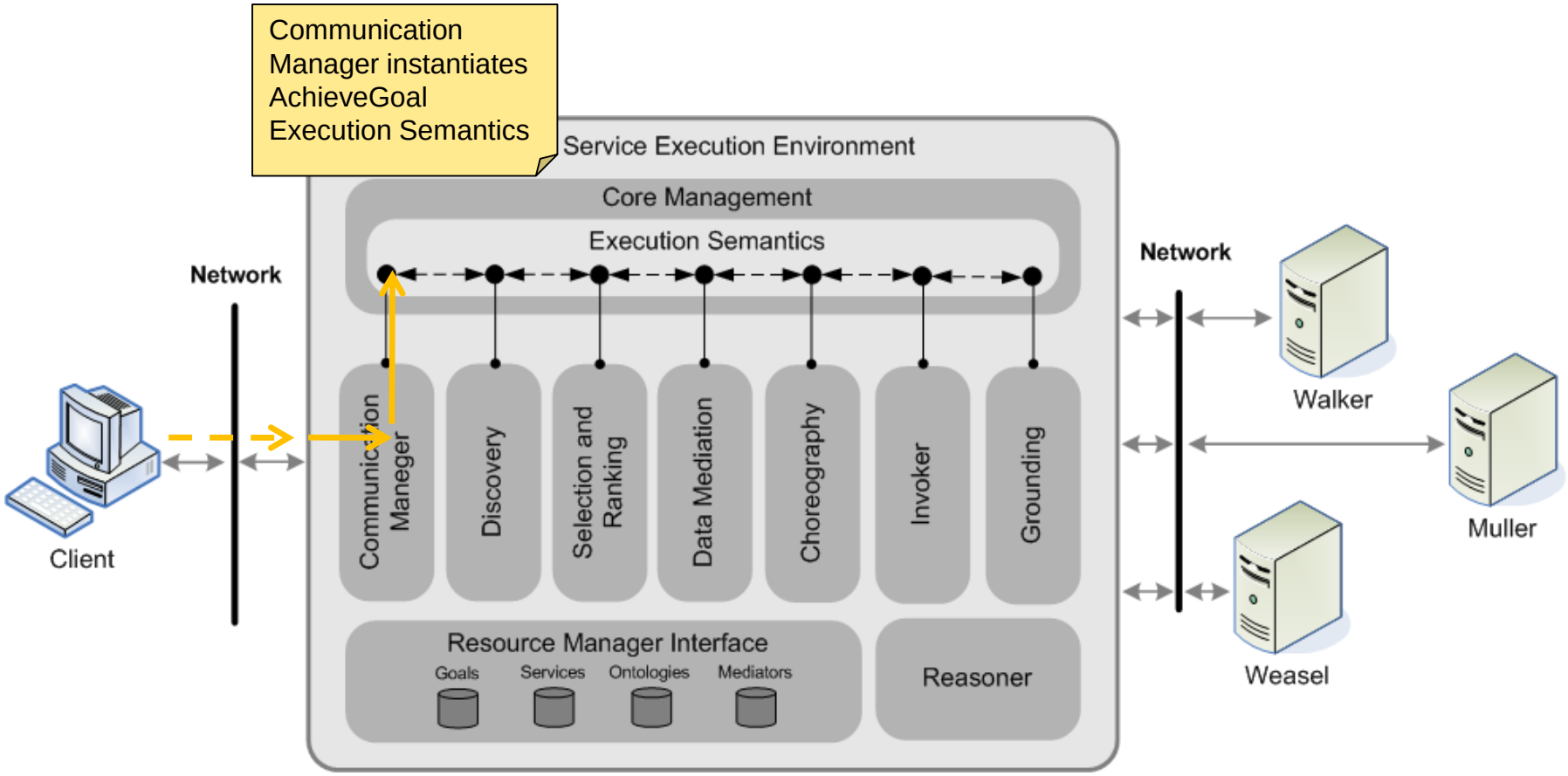
WSMX Illustration



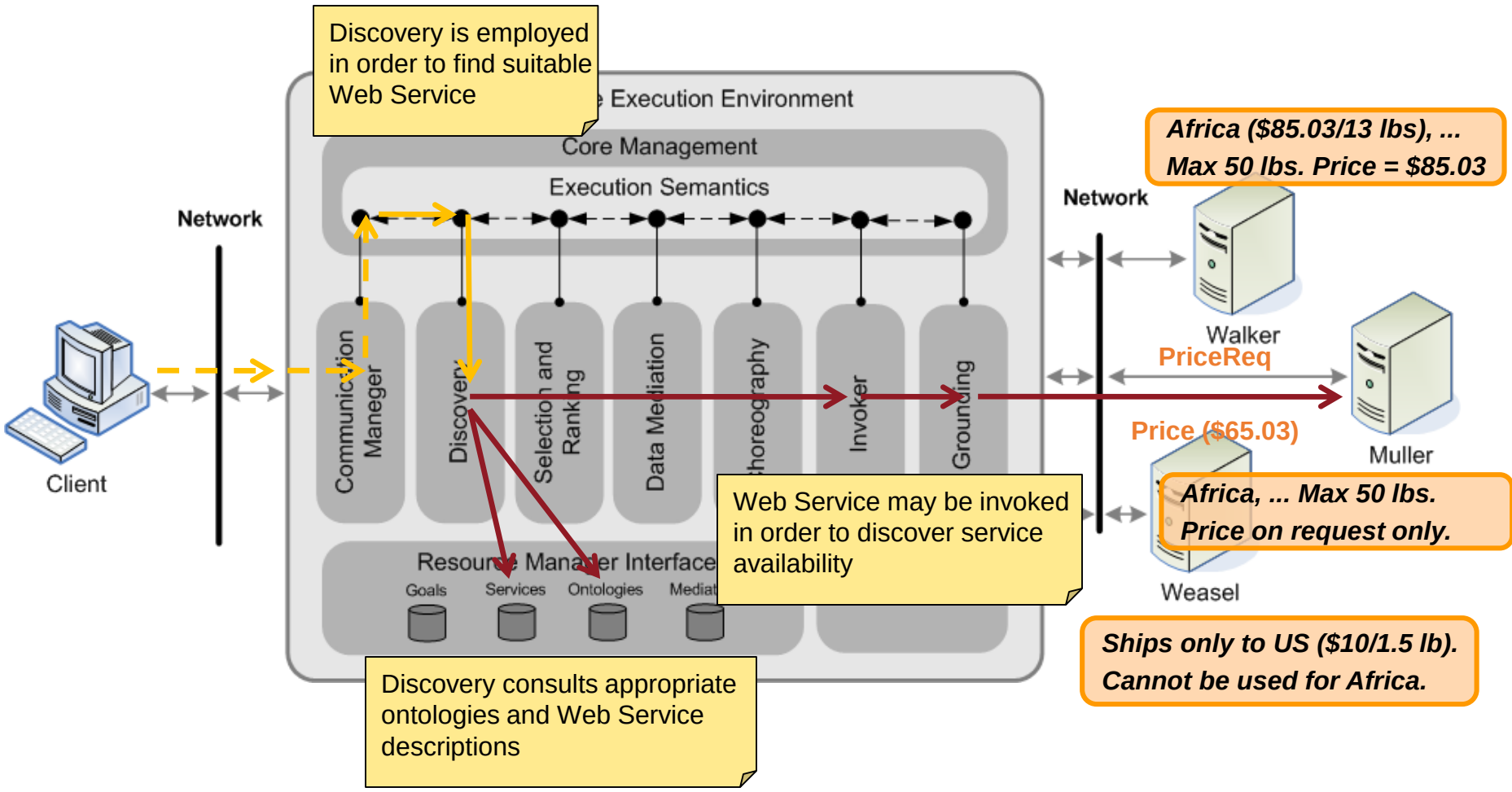
WSMX Illustration



WSMX Illustration



WSMX Illustration



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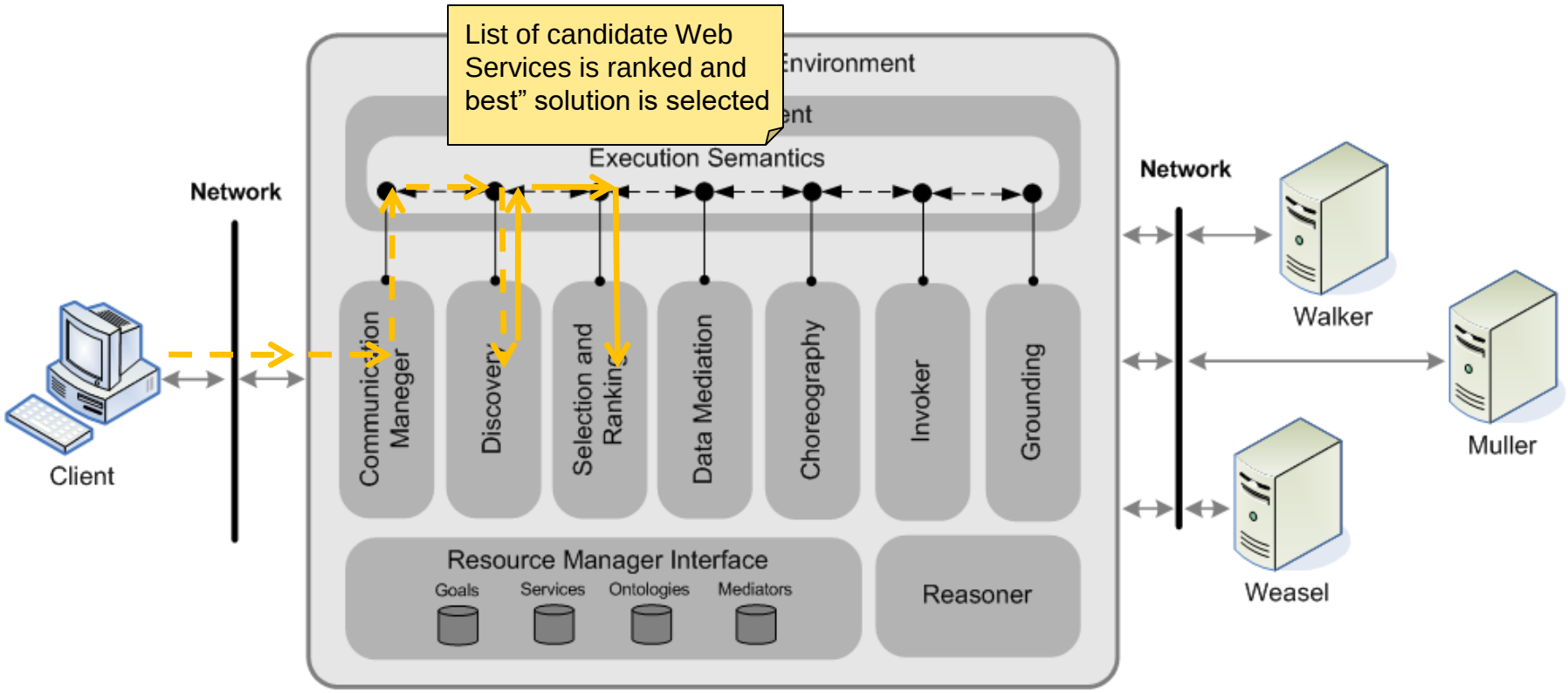
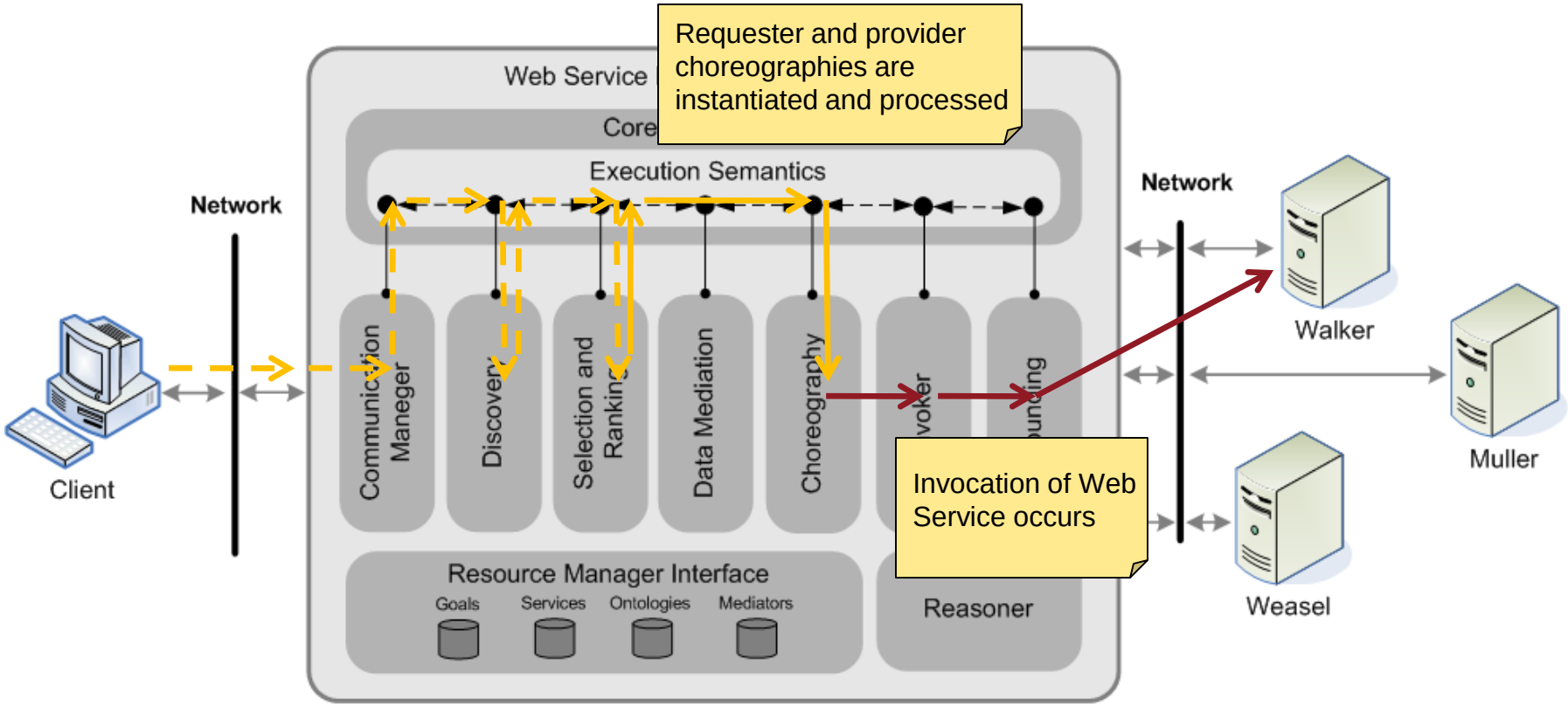


WSMX Illustration



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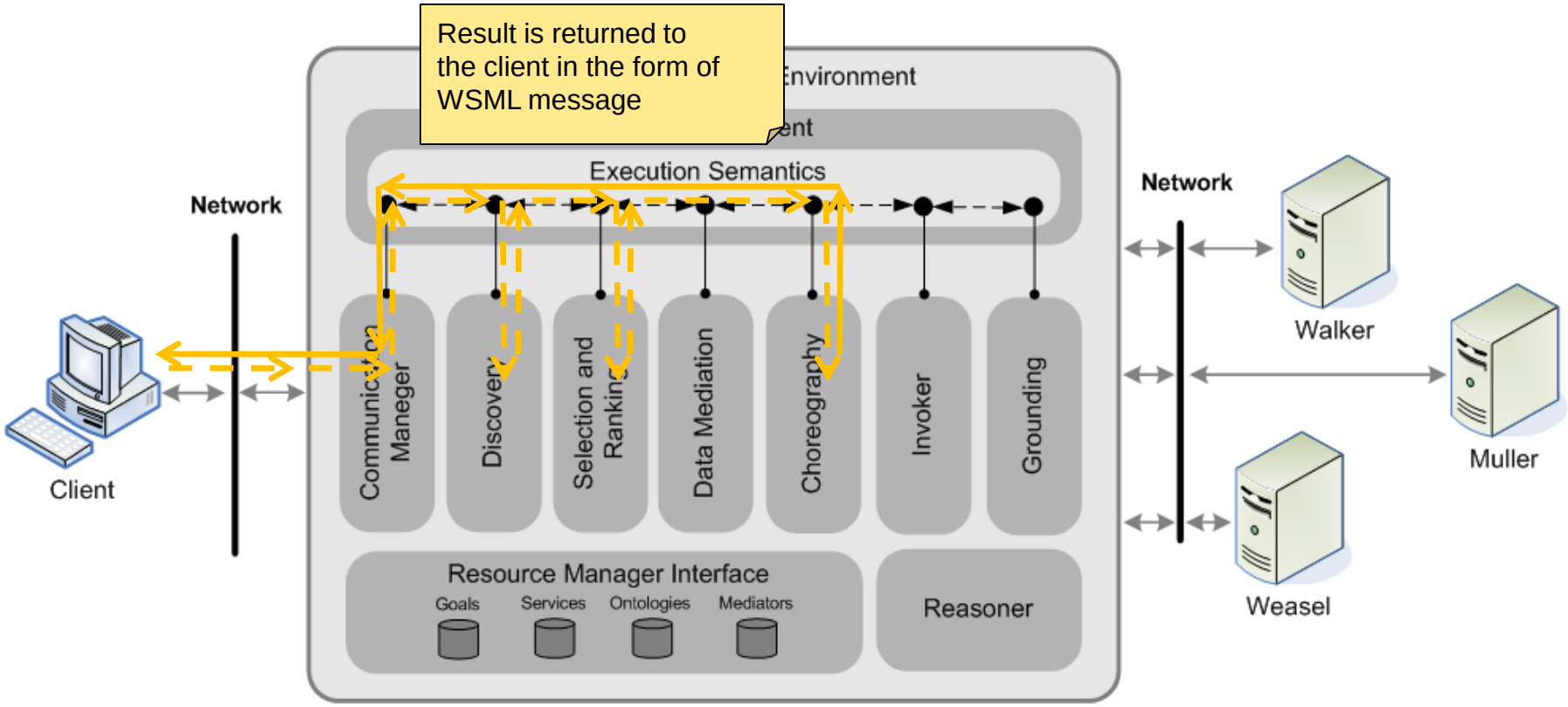
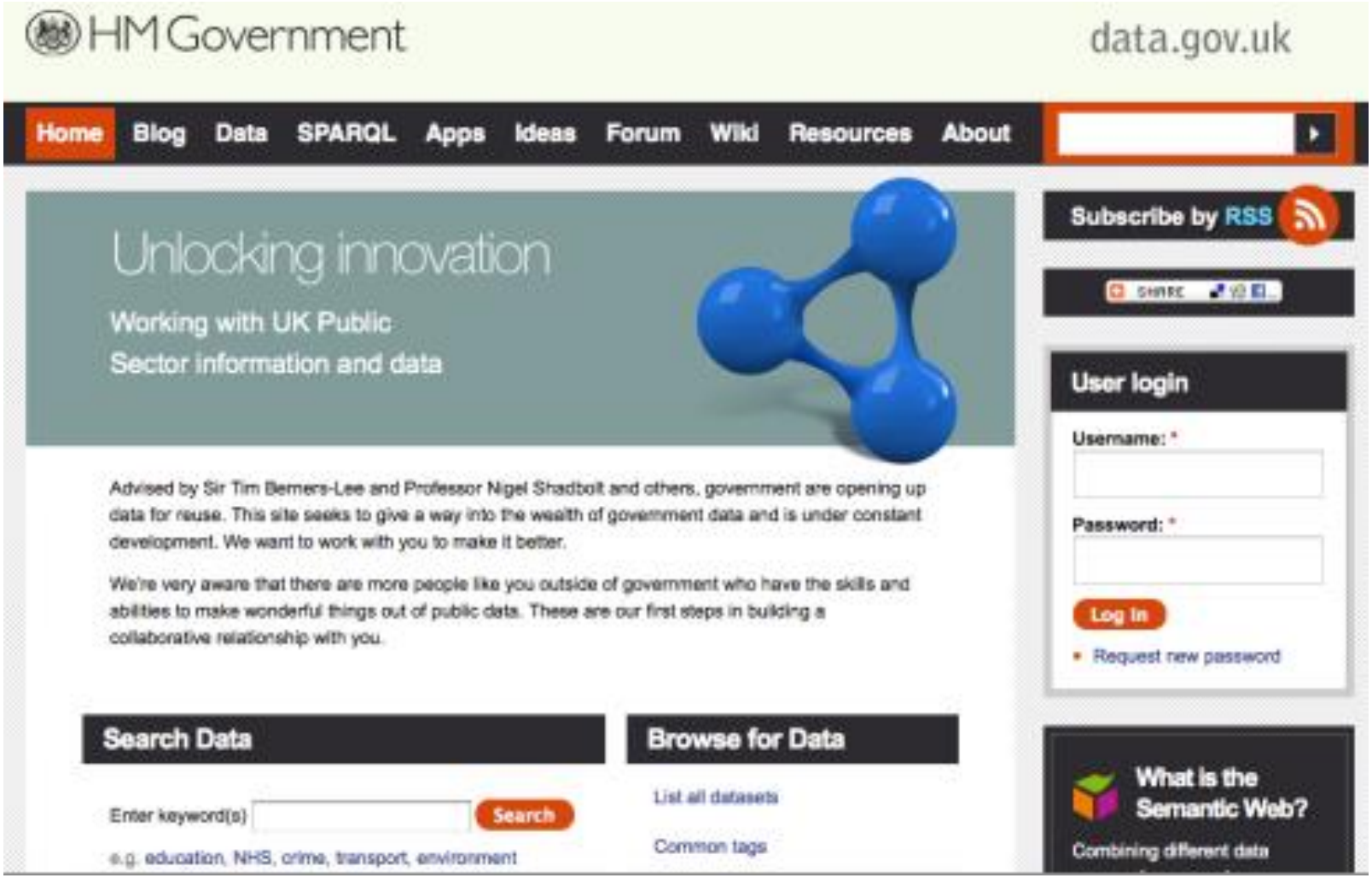


RECENT TRENDS

Open government UK

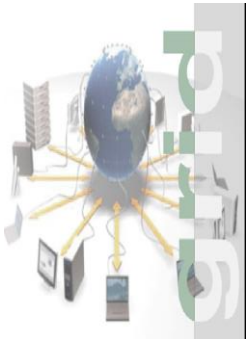


Open government UK

- British government is opening up government data to the public through the website **data.gov.uk**.
- **data.gov.uk** has been developed by Sir Tim Berners-Lee, founder of the Web and Prof. Nigel Shadbolt at the University of Southampton.
- **data.gov.uk** was lunched in January 2010
- **data.gov.uk** will publish governmental non-personal data using the *Resource Description Framework (RDF)* data model
- Query of data is possible using *SPARQL*

Cloud computing

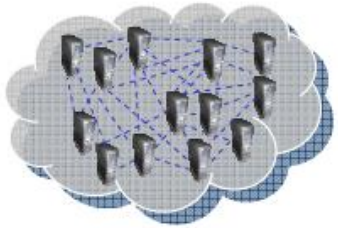
- Grid Computing
  - solving large problems with parallel computing



- Utility Computing
  - Offering computing resources as a metered service

- Software as a service
  - Network-based subscription to applications

- Cloud Computing
  - Next generation internet computing
  - Next generation data centers

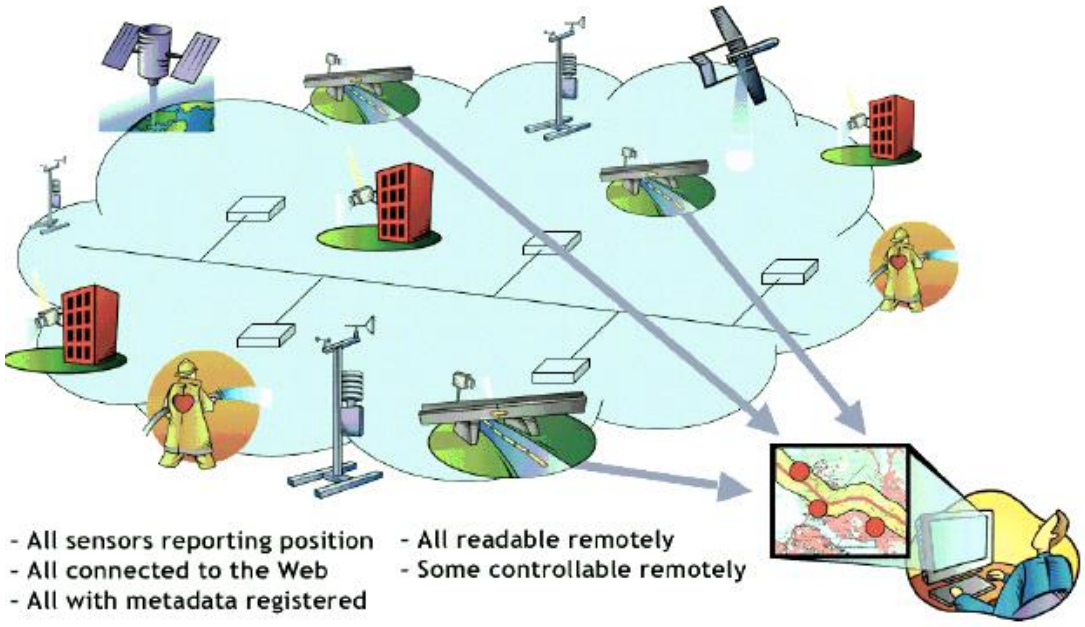


Cloud computing

- Including semantic technologies in Cloud Computing will enable:
  - Flexible, dynamically scalable and virtualized data layer as part of the cloud
  - Accurate search and acquire various data from the Internet,

Mobiles and Sensors

- Extending the mobile and sensors networks with Semantic technologies, Semantic Web will enable:
  - Interoperability at the level of sensors data and protocols
  - More precise search for mobile capabilities and sensors with desired capability



http://www.opengeospatial.org/projects/groups/sensorweb

Linked Open Data and Mobiles

- Combination of Linked Open Data and Mobiles has trigger the emergence of new applications
- One example is **DBpedia Mobile** that based on the current GPS position of a mobile device renders a map containing information about nearby locations from the DBpedia dataset.
- It exploits information coming from DBpedia, Revyu and Flickr data.
- It provides a way to explore maps of cities and gives pointers to more information which can be explored

Linked Open Data and Mobiles

Pictures from DBPedia Mobile

Try yourself: http://wiki.dbpedia.org/DBpediaMobile

SUMMARY

Summary

- Semantic Web is not a ***replacement*** of the current Web, it's an ***evolution*** of it
- Semantic Web is about:
  - annotation of data on the Web
  - data linking on the Web
  - data Integration over the Web
- Semantic Web aims at ***automating*** tasks currently carried out by humans
- Semantic Web is becoming ***real*** (maybe not as we originally envisioned it, but it is)

REFERENCES

References

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- Further reading:
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  - G. Antoniou and F. van Harmelen. *A Semantic Web Primer*, (2nd edition), The MIT Press 2008.
  - H. Stuckenschmidt and F. van Harmelen. *Information Sharing on the Semantic Web*, Springer 2004.
  - T. Berners-Lee. *Weaving the Web*, HarperCollins 2000
  - T.R. Gruber, *Toward principles for the design of ontologies used or knowledge sharing? ,* Int. J. Hum.-Comput. Stud., vol. 43, no. 5-6,1995

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- Wikipedia and other links:
  - http://en.wikipedia.org/wiki/Semantic_Web
  - http://en.wikipedia.org/wiki/Resource_Description_Framework
  - http://en.wikipedia.org/wiki/Linked_Data
  - http://www.w3.org/TR/rdf-primer/
  - http://www.w3.org/TR/rdf-mt/
  - http://www.w3.org/People/Ivan/CorePresentations/RDFTutorial
  - http://linkeddata.org/
  - http://www.opengeospatial.org/projects/groups/sensorweb
  - http://www.data.gov.uk/

Questions?