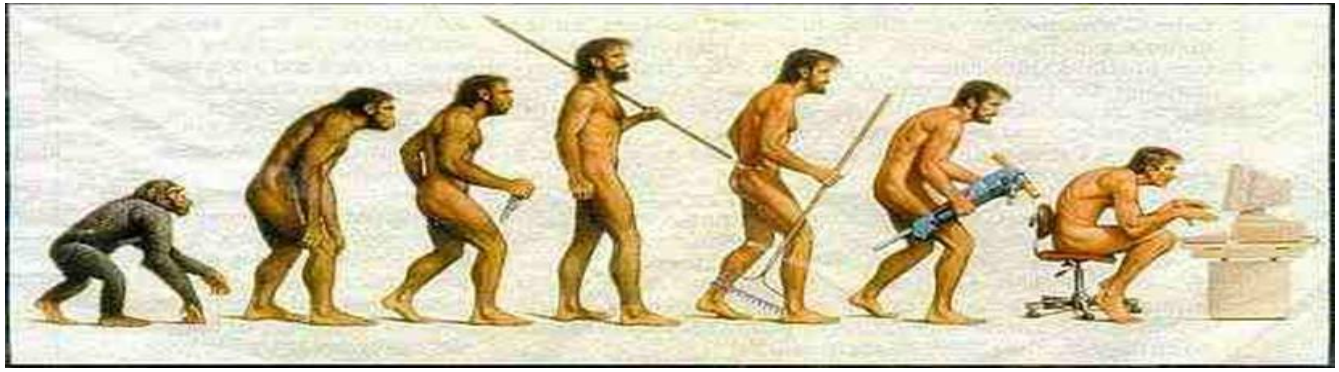
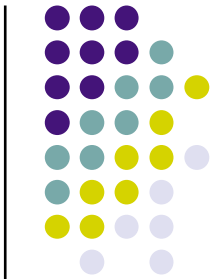
Semantic Web: Past, Now, Future

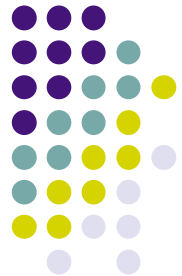
Ying Ding
SLIS, IU





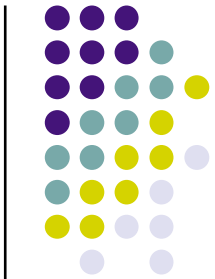
What is Semantic Web?

What is the Semantic Web?



- *"An extension of the current Web in which information is given well-defined meaning, better enabling computers and people to work in cooperation."*
  - Sir Tim Berners-Lee et al., Scientific American, 2001: tinyurl.com/i59p
- *"…allowing the Web to reach its full potential…"* with far-reaching consequences
- *"The next generation of the Web"*

Semantic Web



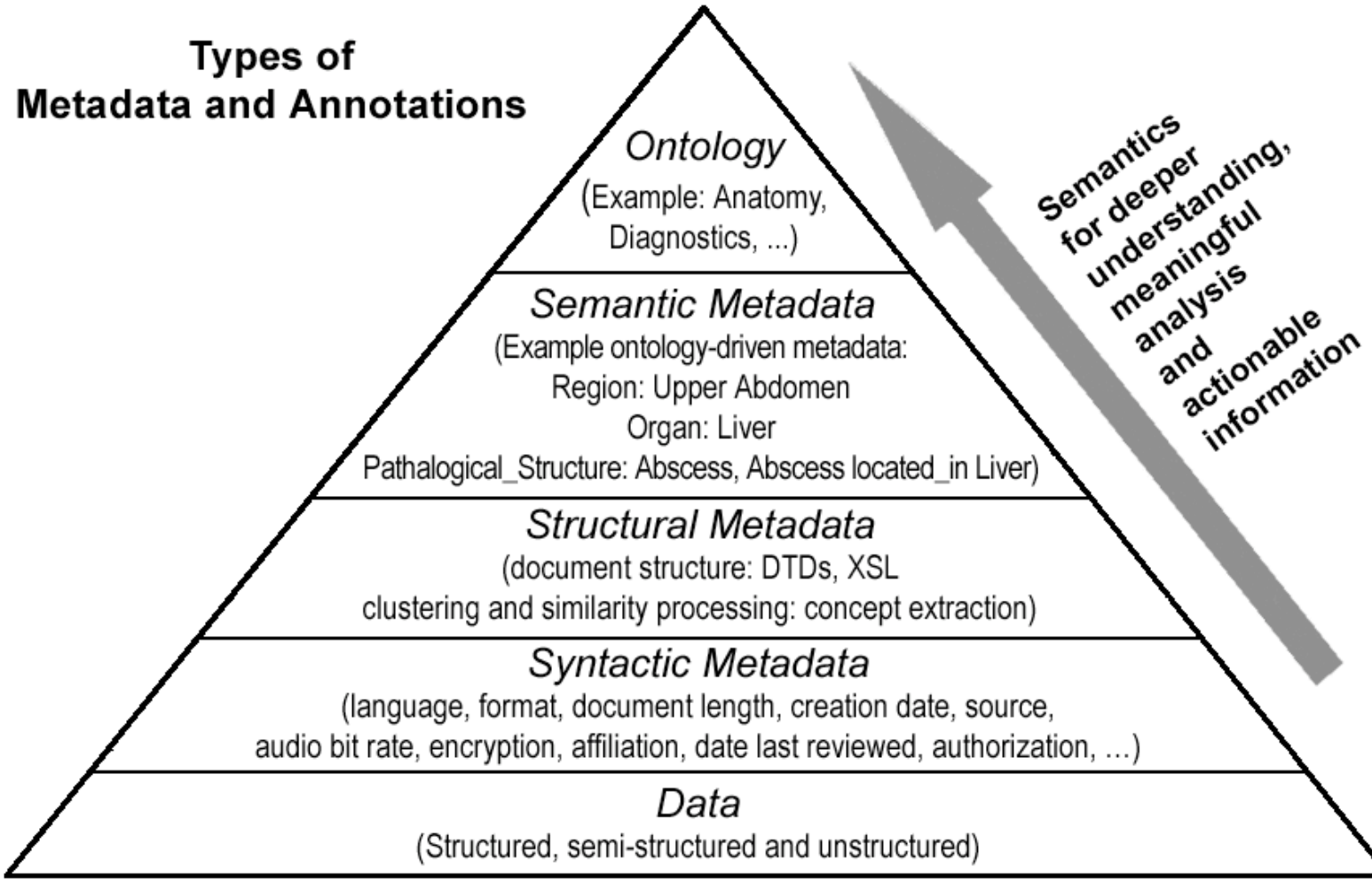
- Tim Berners-Lee has a vision of a Semantic Web which
  - has machine-understandable **semantics** of information, and
  - millions of small specialized **reasoning** services that provide support in automated task achievement based on the accessible information

The Semantic Web in essence

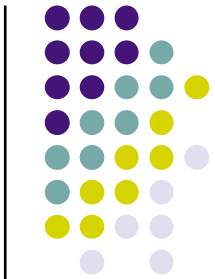
- The word “semantic” stands for “the meaning of”:
  - The Beatles were a popular band from Liverpool; Lennon was a member of the Beatles; "Hey Jude" was recorded by the Beatles

- The Semantic Web is a Web that is able to describe things in a way that computers can process

Metadata and Semantics

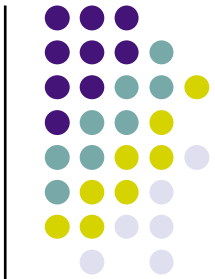


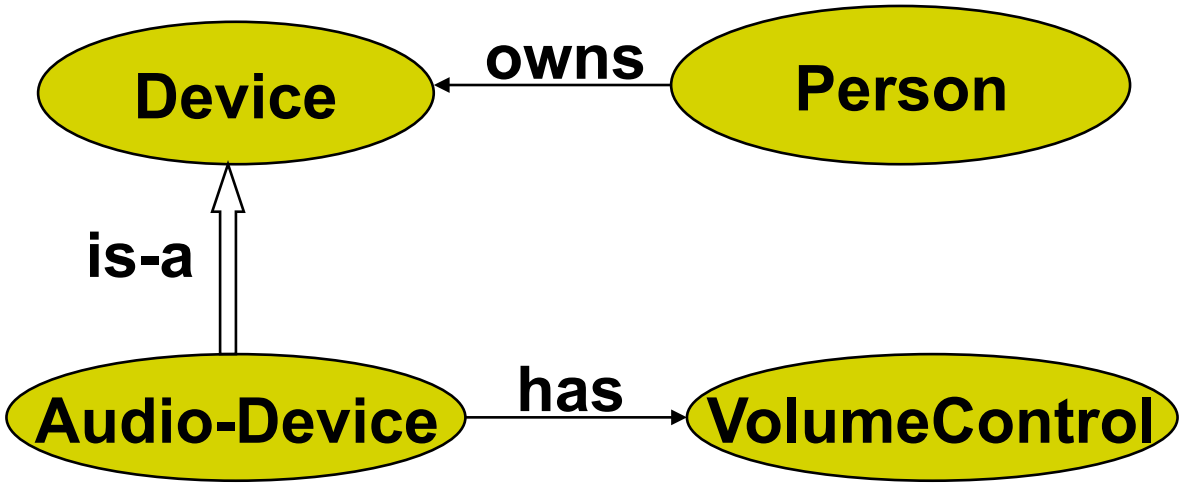
Ontology



- The semantic Web is essentially based on ontologies
  - ***ontologies*** are ***formal*** and ***consensual*** specifications of conceptualizations…
  - providing a ***shared and common*** understanding of a domain that can be communicated across people and application systems

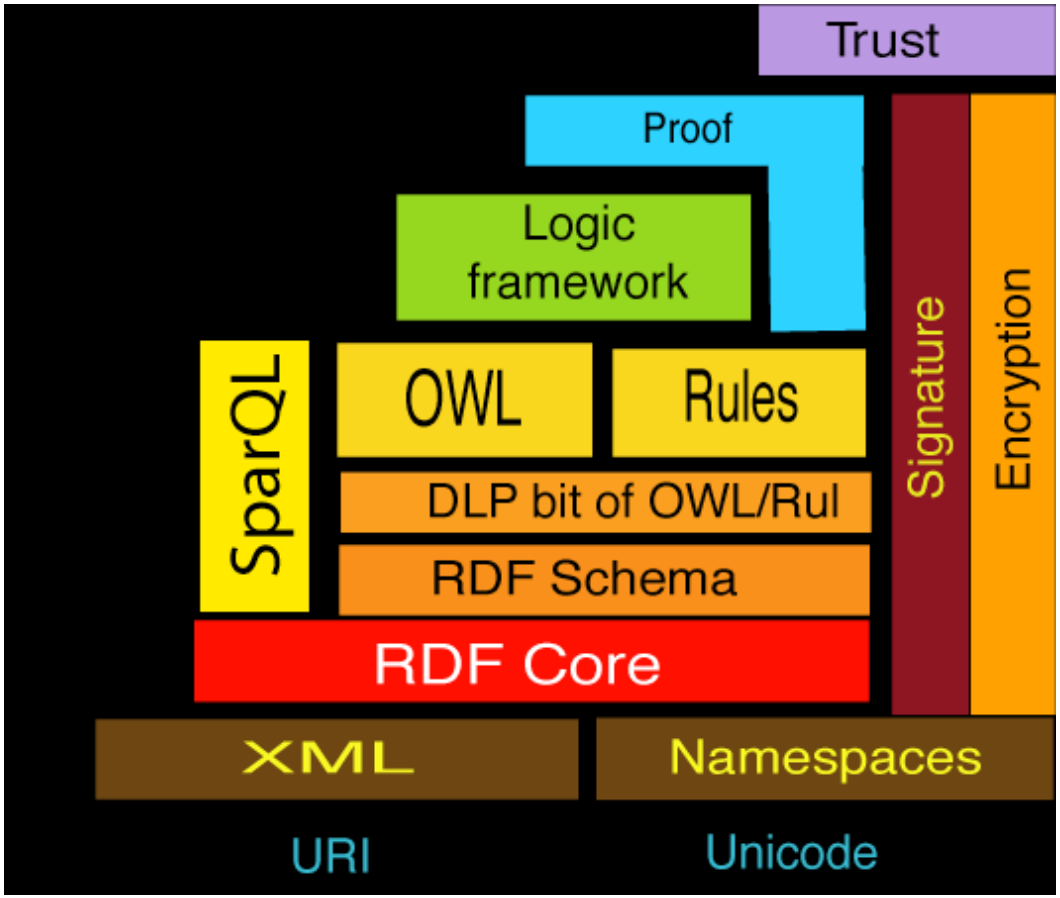
A very simple Ontology





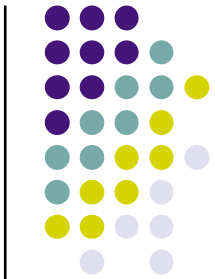
Ontologies describe *concepts* and their *Relations.*

Semantic Web - Language tower



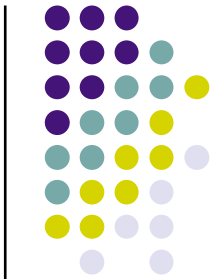
Tim Berners-Lee Keynote Speech in 2005

What is Semantic Web for?



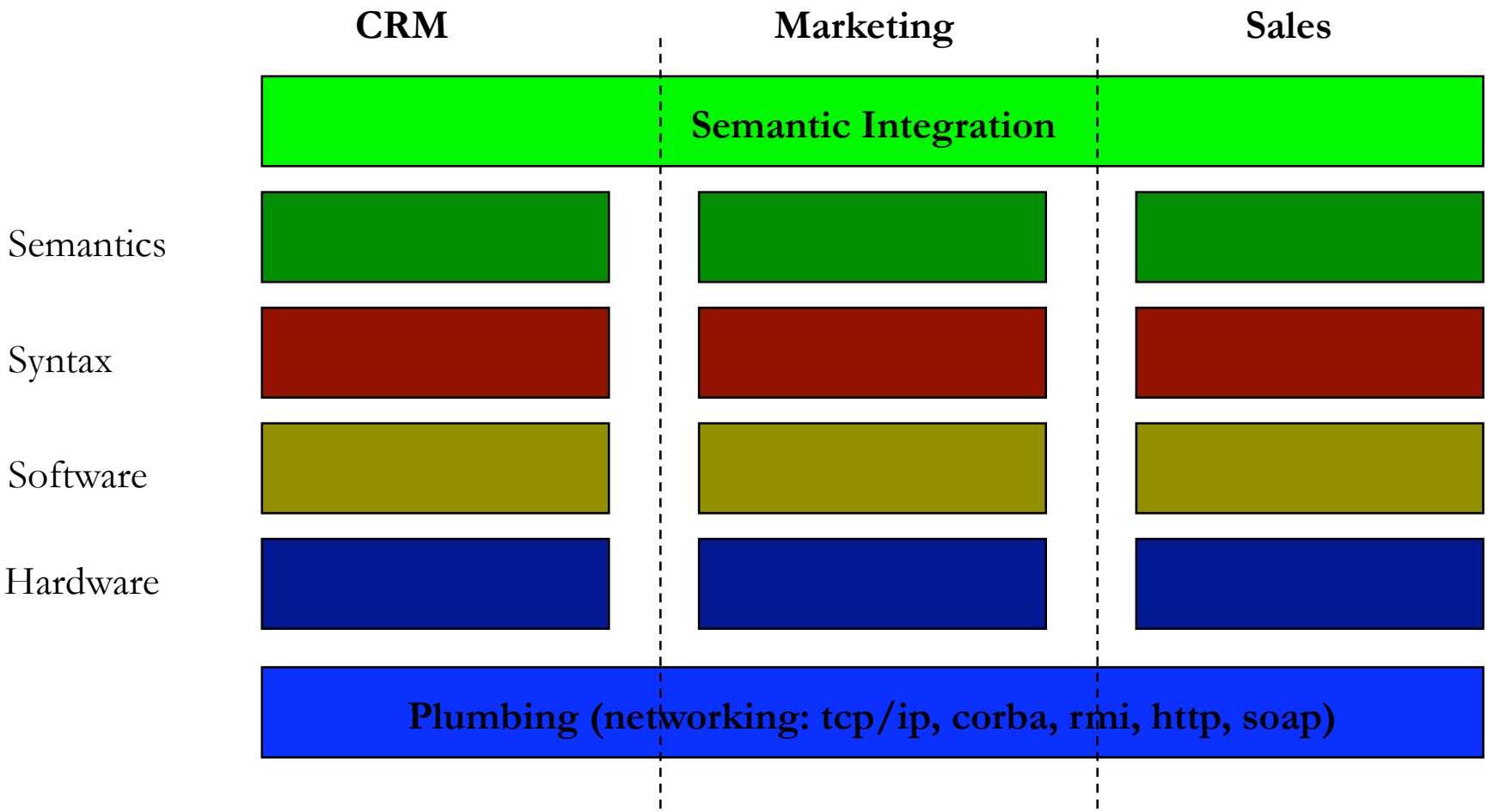
- Integrating - trying to solve the problem of data and service integration
- Searching - Providing better communication between human and computers by adding machine-processable semantics to data.

Semantic Integration

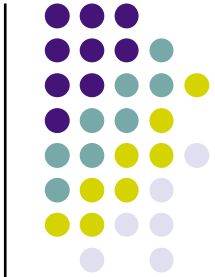


- Top-Down approach: Building up different domain ontologies for better data integration and communication within the domain:
  - PapiNet.org: Vocabulary for Paper Industry
  - BPMI.org: Vocabulary for exchanging Business Process Models
  - XML-HR: Vocabularies for human resources (HR)
  - DMTF: Distributed Management Task Force: Vocabularies for managing enterprises

Semantic Integration



Semantic Differences: Example



Marketing

Person

P#	76798
Name	de Bruijn
FName	Jos
DName	Jos de Bruijn
BDate	1979-06-23
LSale	2001-04-07

?

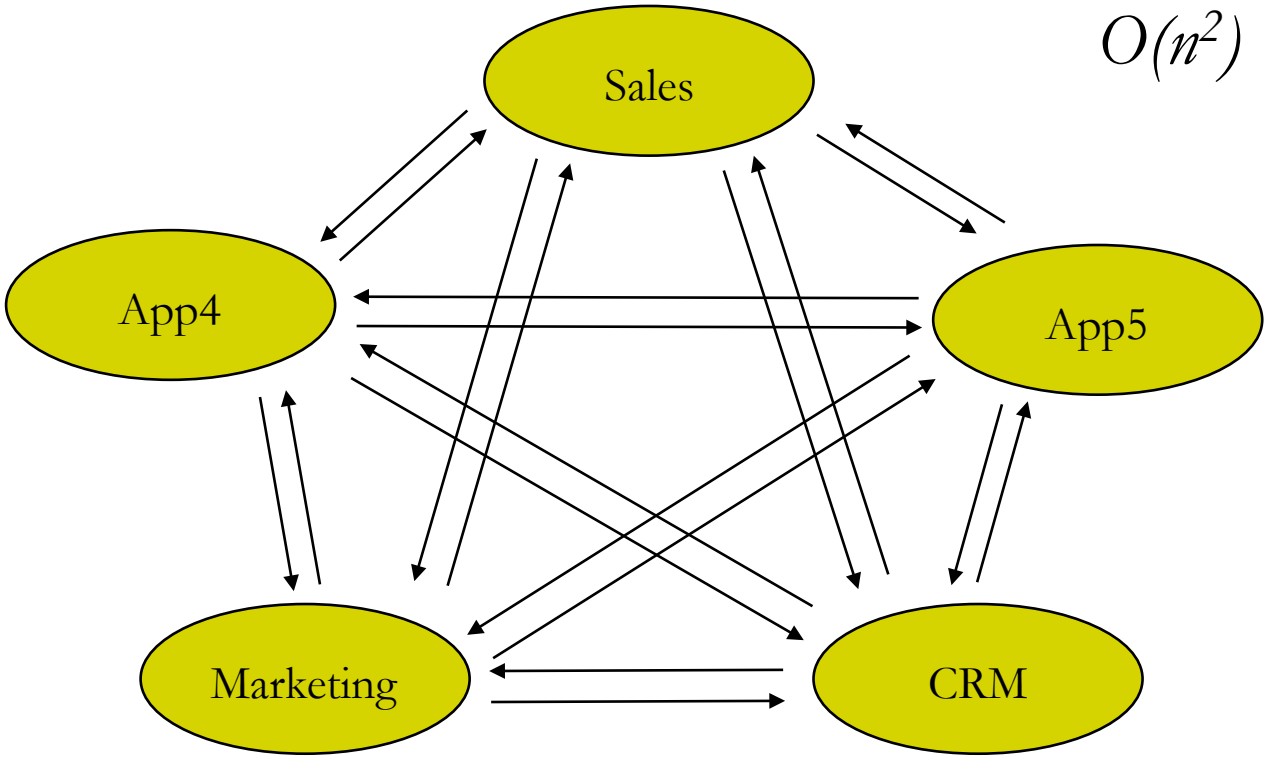
Sales

Customer

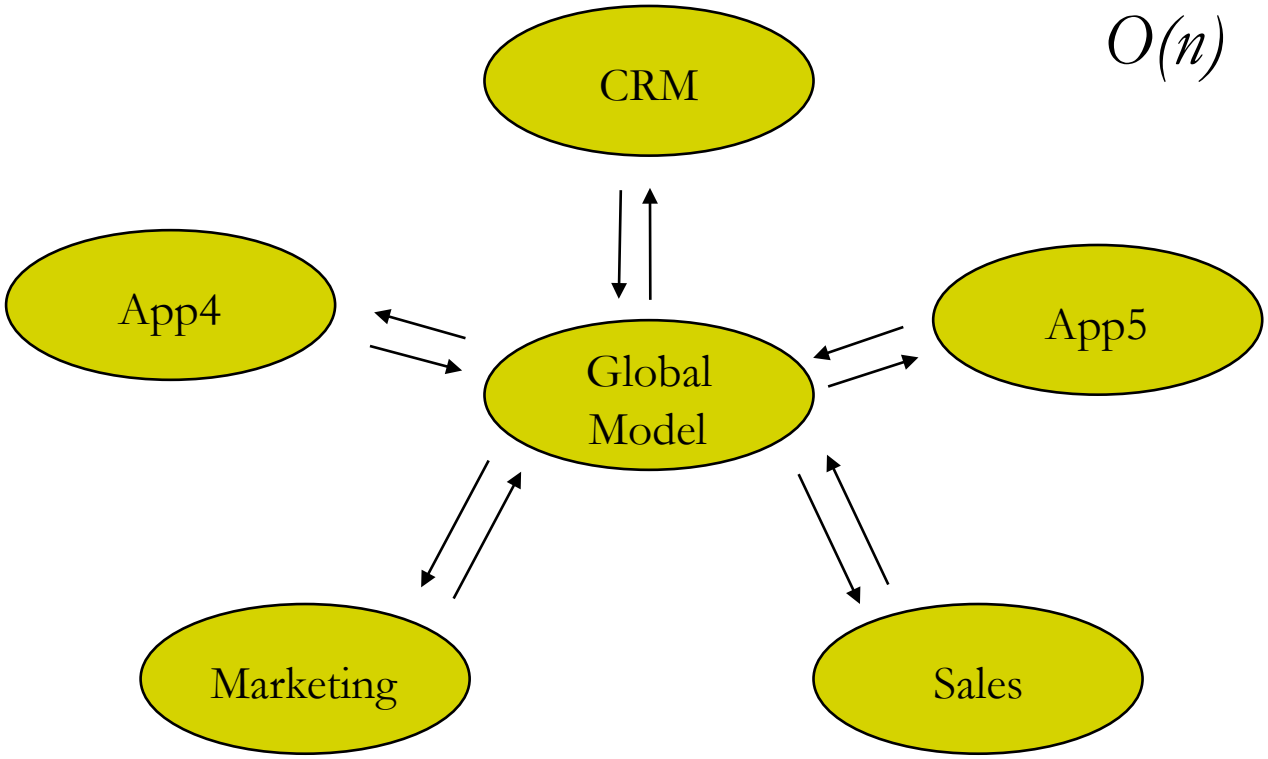
CustNr	43526
Name	Jos Debruijn
Surname	Debruijn
Initials	J
BDate	1979-06-23

	Syntax	Semantics
1.	distinct	equivalent
2.	equivalent	distinct
3.	equivalent	equivalent
4.	distinct	distinct

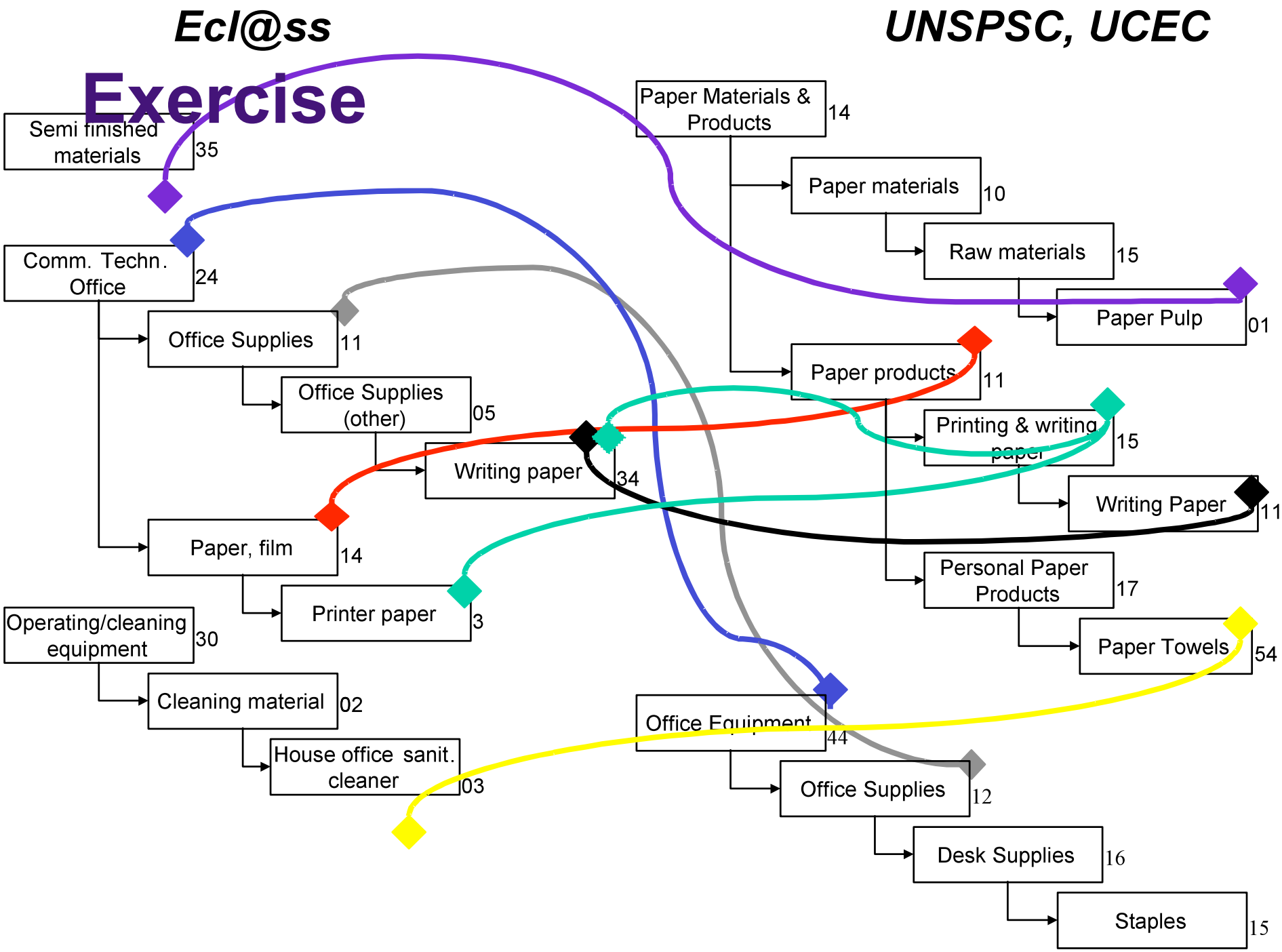
Information Integration Patterns (1): *Ad Hoc* Integration



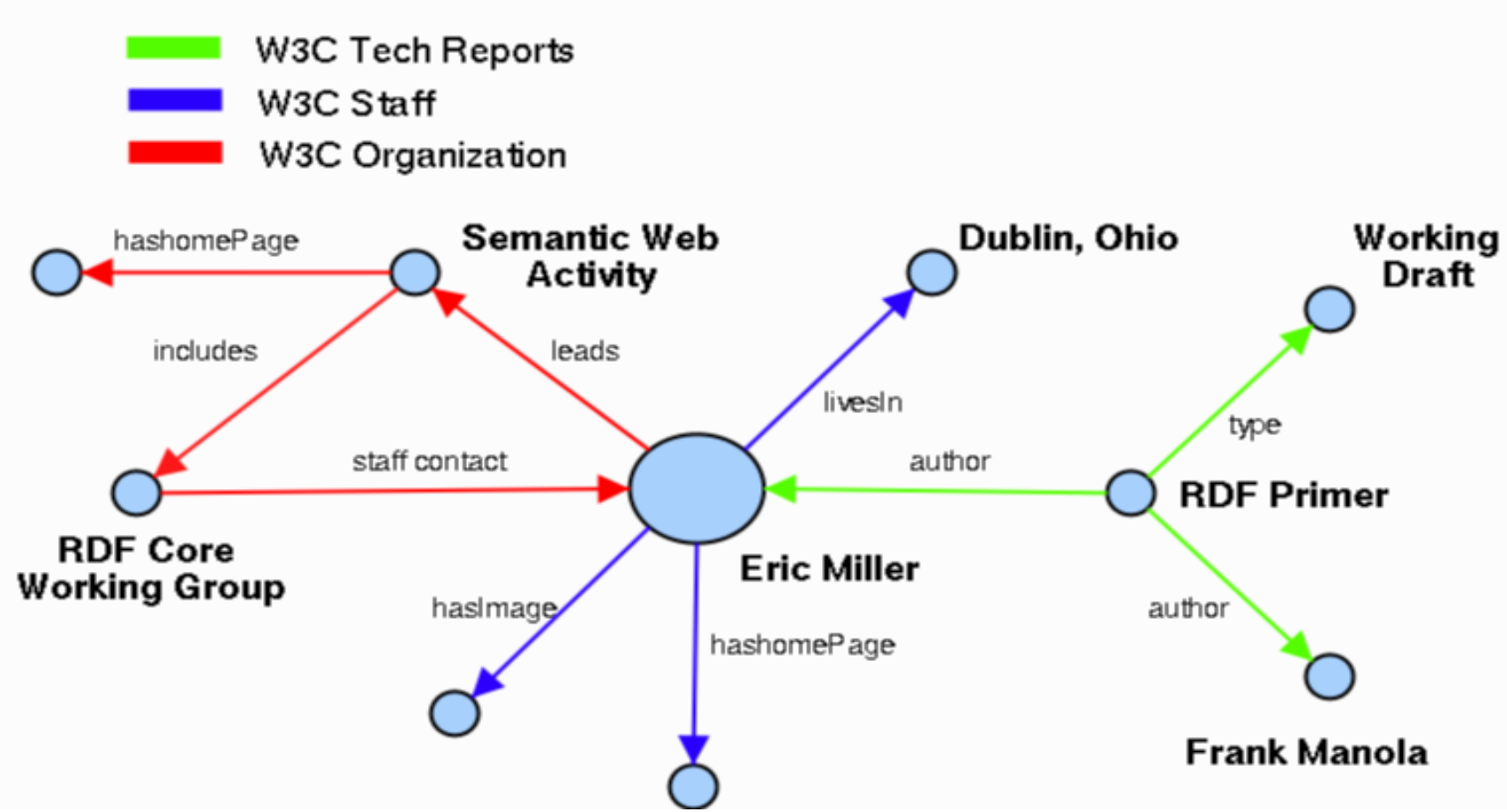
Information Integration Patterns (2): *Global* Integration



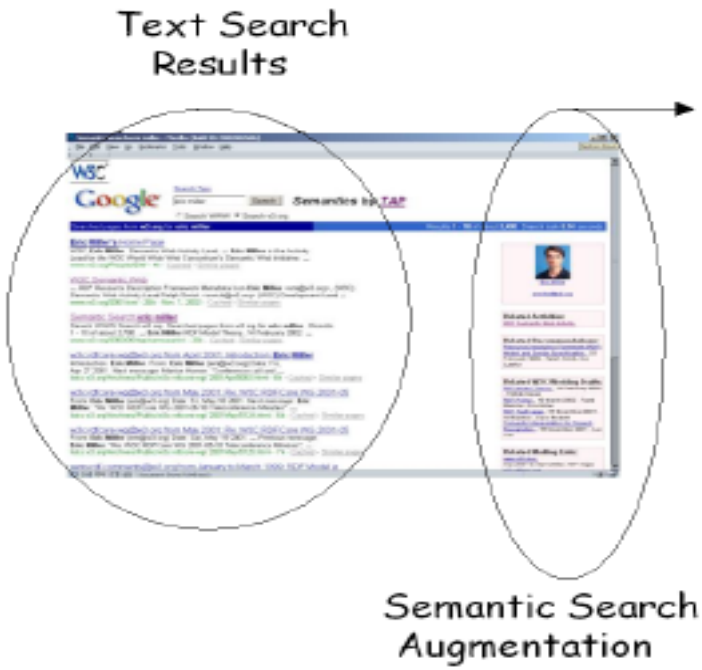
Not silver bullet!


Ecl@ss
UNSPSC, UCEC
Exercise
Semi finished materials
35
Comm. Techn. Office
24
Office Supplies
11
Office Supplies (other)
05
Writing paper
34
Paper, film
14
Printer paper
3
Operating/cleaning equipment
30
Cleaning material
02
House office sanit. cleaner
03
Paper Materials & Products
14
Paper materials
10
Raw materials
15
Paper Pulp
01
Paper products
11
Printing & writing paper
15
Writing Paper
11
Personal Paper Products
17
Paper Towels
54
Office Equipment
44
Office Supplies
12
Desk Supplies
16
Staples
15

Semantic Searching



Semantic Searching



Eric Miller

emiller@w3.org

Related Activities:
W3C Semantic Web Activity

Related Recommendations:
Resource Description Framework (RDF) Model and Syntax Specification , 22 February 1999 . Ralph Swick, Ora Lassila

Related W3C Working Drafts:
RDF Model Theory , 14 February 2002 . Patrick Hayes
RDF Primer , 19 March 2002 . Frank Manola , Eric Miller
RDF Test Cases , 15 November 2001 . Art Barstow , Dave Beckett
Semantic Interpretation for Speech Recognition , 16 November 2001 . Luc Van

Related Mailing Lists:
www-rdf-rules
Sep 2001 to April 2002 (197 msgs)

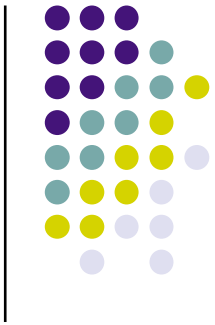
Information from AllMusic

Top Albums:
Soul of the Tango
Appalachia Waltz
Simply Baroque
Transcriptions
Portrait of Yo-Yo Ma

Biography:
Yo-Yo Ma was the cello's foremost contemporary proponent; while primarily a classical performer, he also made a number of highly successful crossover recordings. Born October 7, 1955 to Chinese parents living in Paris, he began playing ...
See full bio.

Shop@AOL
800.Com Music - Soul Of The Tango - ...
Appalachia Waltz / Yo-Yo Ma, Edgar ...
Yo-Yo Ma: Made In America: $11.97
800.Com Music - Brahms: Sonatas For ...
Grappelli Stephane/Yo Yo Ma: Anythi ...
More Shopping@AOL

Concert tickets from TicketMaster
Silk Road Project With Yo Yo Ma-Cello
On 5/12/02 at Seattle, WA
Silk Road Project With Yo Yo Ma-Cello
On 5/13/02 at Seattle, WA
Seattle Symphony Silk Road Project ...
On 5/14/02 at Seattle, WA
Silk Road Project With Yo Yo Ma-Cello
On 5/15/02 at Seattle, WA
Seattle Symphony Silk Road Project ...
On 5/16/02 at Seattle, WA
More TicketMaster concerts

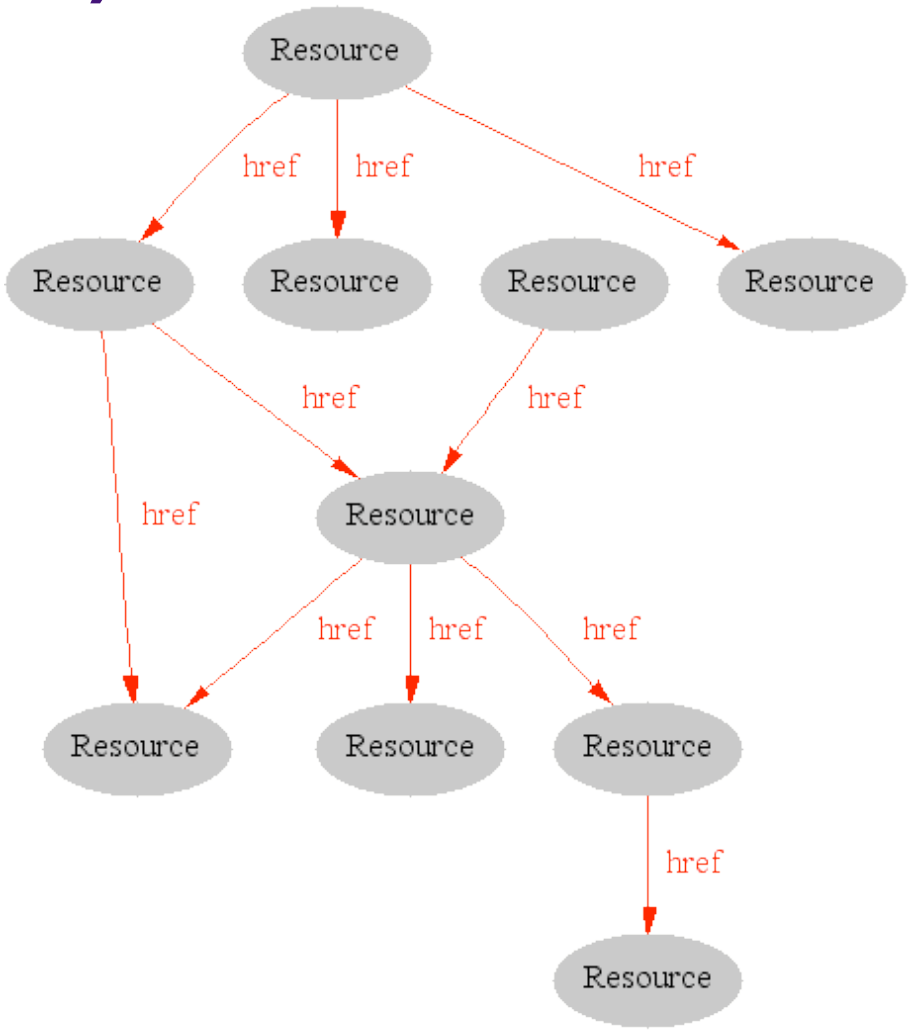


Semantic Web: Past

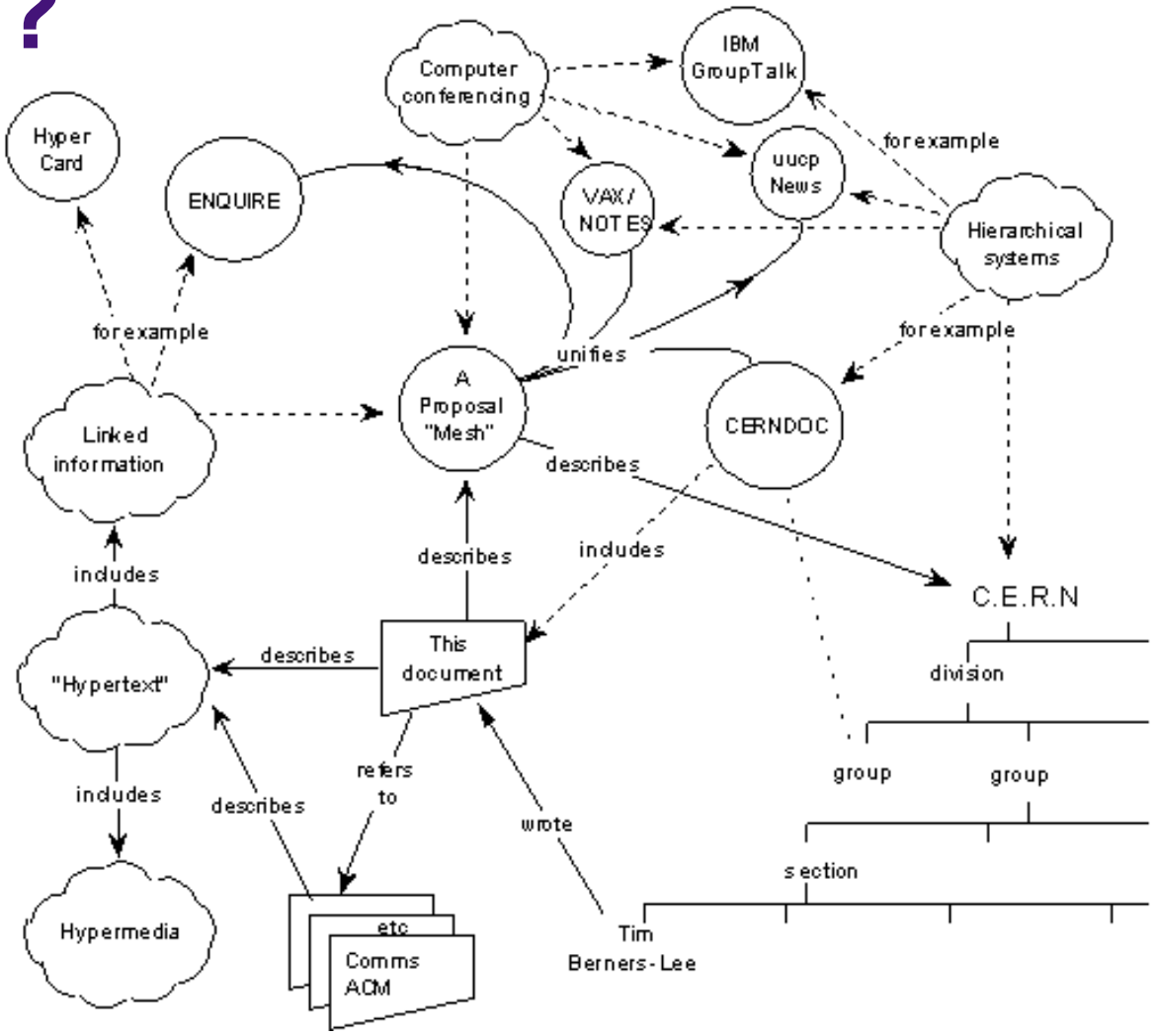
WWW – Web 1.0


.:: DERI Innsbruck - Details ::. - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.deri.at/teaching/courses/ss2007/details/next-web-generation/
Getting Started Latest Headlines post to del.icio.us my del.icio.us
DERI INNSBRUCK
Leopold-Franzens Universität Innsbruck
Home Contact
About Research Teaching Digital Library
DERI Locations
DERI Innsbruck
Events
Stream
Courses
SS2007
WS2006/07
SS2006
WS2005/06
SS2005
WS2004/05
Theses
Teaching > Courses > SS2007 > Details
Print
Details
Next Web Generation
The course is an introduction to a set of new technologies for building Next Web Generation. In the first two parts we will discuss mechanisms for representing, manipulating and querying structured data (XML) respectively semantic data (RDF, OWL) on the Web. In the third, and last part of the course we will discuss how to build and integrate distributed applications using Web services.
Catalogue
VU3 (703219)
Lecturer(s)
Ying Ding
Tutor(s)
Ioan Toma
Language
English
Time
Gr.0: Mi 10-12:00 HS 10;
Gr1: Di 16-17:00 rr 15
Jump to top.
Contact person in charge.
Ubicomp07
September 16-19, 2007
Innsbruck, Austria
ICEC 2007
August 19-22, 2007
Minneapolis, Minnesota, US
ICEC 2008
August 1, 2008
Innsbruck, Austria
Imprint | Mailinglists
© Copyright 2004-2006 by the Digital Enterprise Research Institute (DERI). All rights reserved.
Done
start
100%
9:48 PM

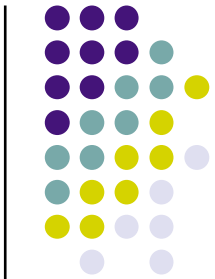
The current (syntactic / structural) Web



Was the Web meant to be more?



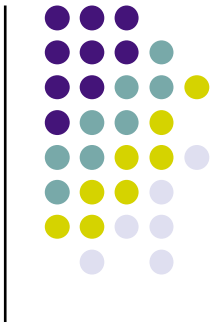
How to realize Tim's vision



- Another chance for "Artificial Intelligence (AI)"?
  - Knowledge Representation (representing semantics)
  - Logic Programming (reasoning semantics)

- Decisions for:
  - Background logic for semantic web language (RDF, OWL)
    - Description Logic
    - DAPAR + EU = DAML+OIL (in 2001)

AI Influence

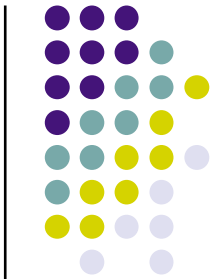


- Too much AI
  - Ontologies are too heavy
    - Too many axioms, complicated rules, concepts and relationships
  - Things are too formal
    - Too many formal logic, logic reasoning,
    - Knowledge base, expert system

Ontology or Oncology?

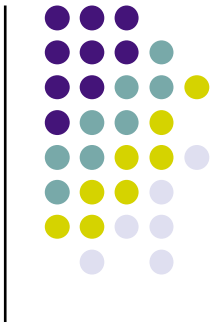
- Struggle to form a community
  - EU funding – ontoweb project (http://cordis.europa.eu/ist/ka3/iaf/projects/ontoweb.htm)
  - Lay the foundation for the birth of the Semantic Web community
  - Now it is continued as KnowledgeWeb (http://knowledgeweb.semanticweb.org/semanticportal/sewView/frames.html)

Slowly we found our stand



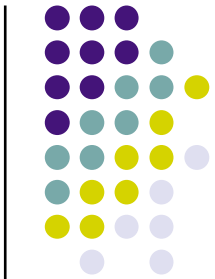
- Stand in the scientific community
  - Own international conference (ISWC, ESWC, ASWC)
  - Own journal (JoDS)
  - A research field -- topics in many other major conferences
  - Education

- Chances in Industry
  - Semantic Technology (http://www.semantic-conference.com/)
  - Europe



Semantic Web: Now

Social Web – Web 2.0



- The term *Web 2.0* was made popular by Tim O'Reilly:
  - http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html
- http://en.wikipedia.org/wiki/Web_2.0
  - *"Web 2.0 … has … come to refer to what some people describe as a second phase of architecture and application development for the World Wide Web."*
- The Web where "ordinary" users can meet, collaborate, and share using **social software** applications on the Web (tagged content, social bookmarking, AJAX, etc.)
- Popular examples include:
  - Bebo, del.icio.us, digg, Flickr, Google Maps, Skype, Technorati, orkut, 43 Things, Wikipedia…

Social Networks

blip.tv
Your video, your way

BUBBLESHARE

43 Things

facebook

Technorati

del.icio.us

YouTube

flickr

diigo

shadows

mypage beta

myspace.com

blinklist

simpy

slideshare

citeulike

Connotea

Taggly

A move from the Web to a "social Web"

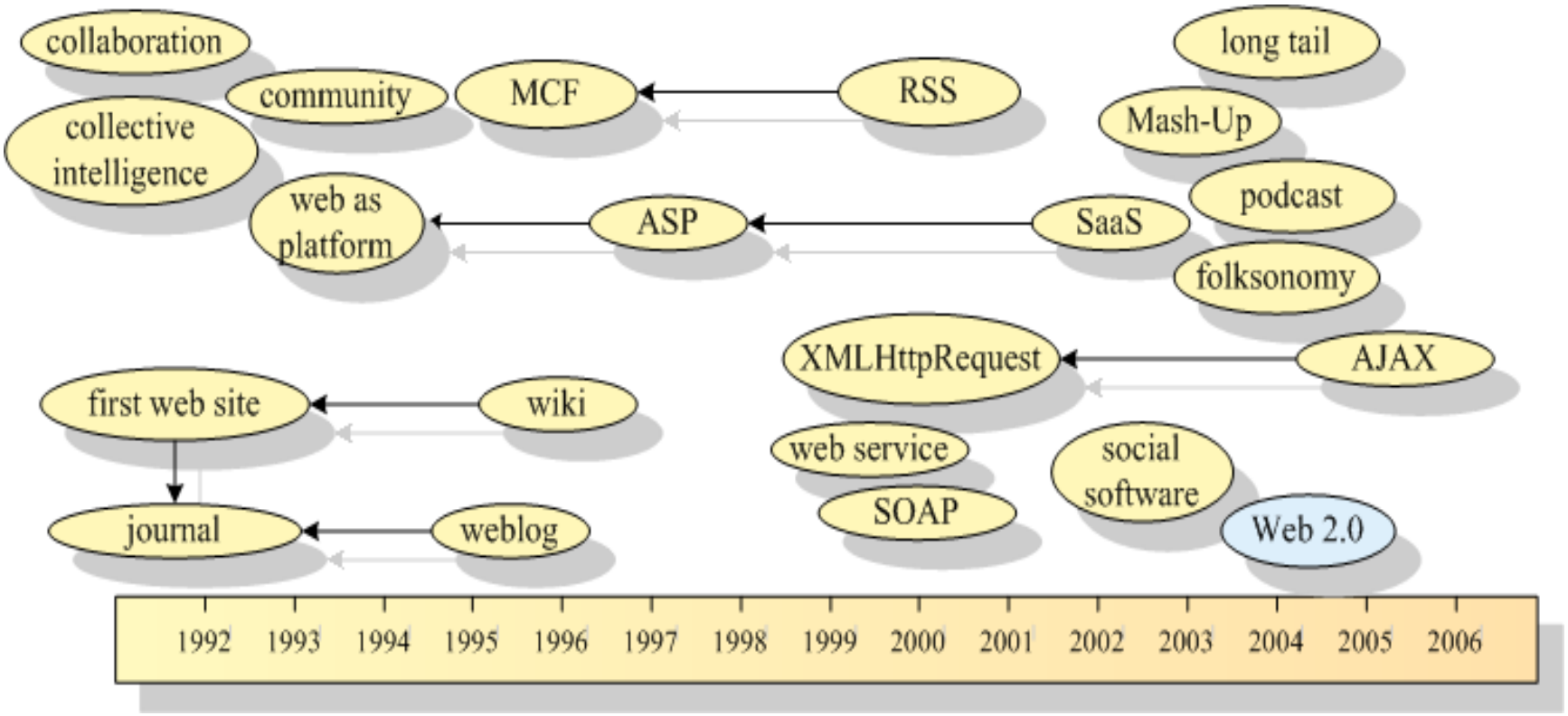
"On the Internet, nobody knows you're a dog." (A dog, sitting at a computer terminal, talking to another dog.)

ID: 22230, Published in *The New Yorker* July 5, 1993

"I had my own blog for a while, but I decided to go back to just pointless, incessant barking." (One dog talking to another.)

ID: 121304, Published in *The New Yorker* September 12, 2005

When did Web 2.0 appear?



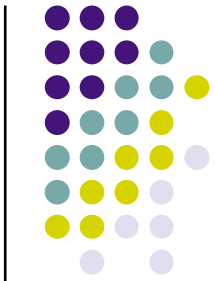
Features / principles of Web 2.0

- http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

1. The Web as platform
2. Harnessing collective intelligence
3. Data is the next “Intel Inside”
4. Rich user experiences

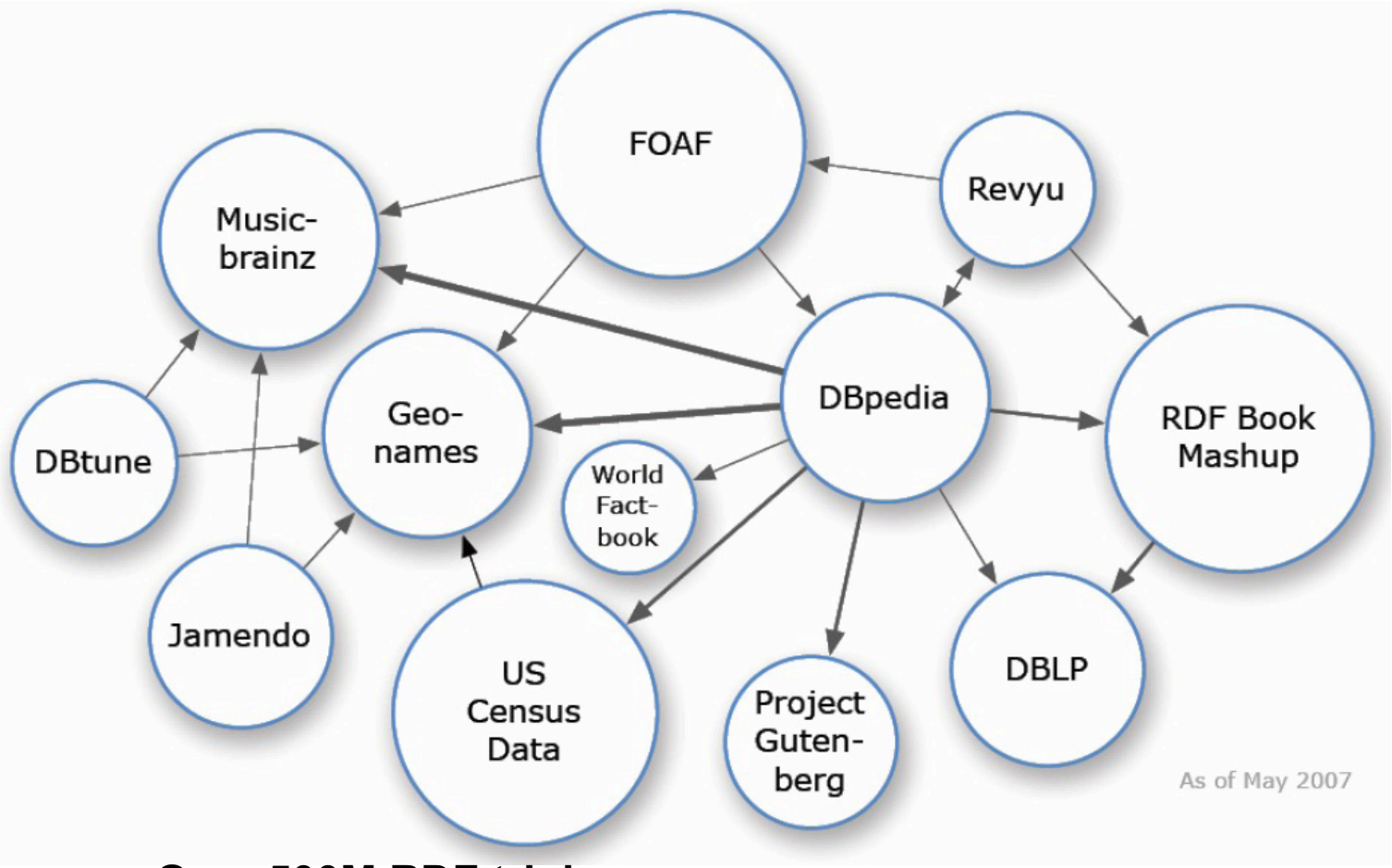
Web 2.0 meme cloud

W3C SWEO Linking Open Data Project



- Project aims to
  - Publish existing open license datasets as linked data on the web
  - Interlink things between different data sources
  - Develop clients and applications that consume linked data from the web

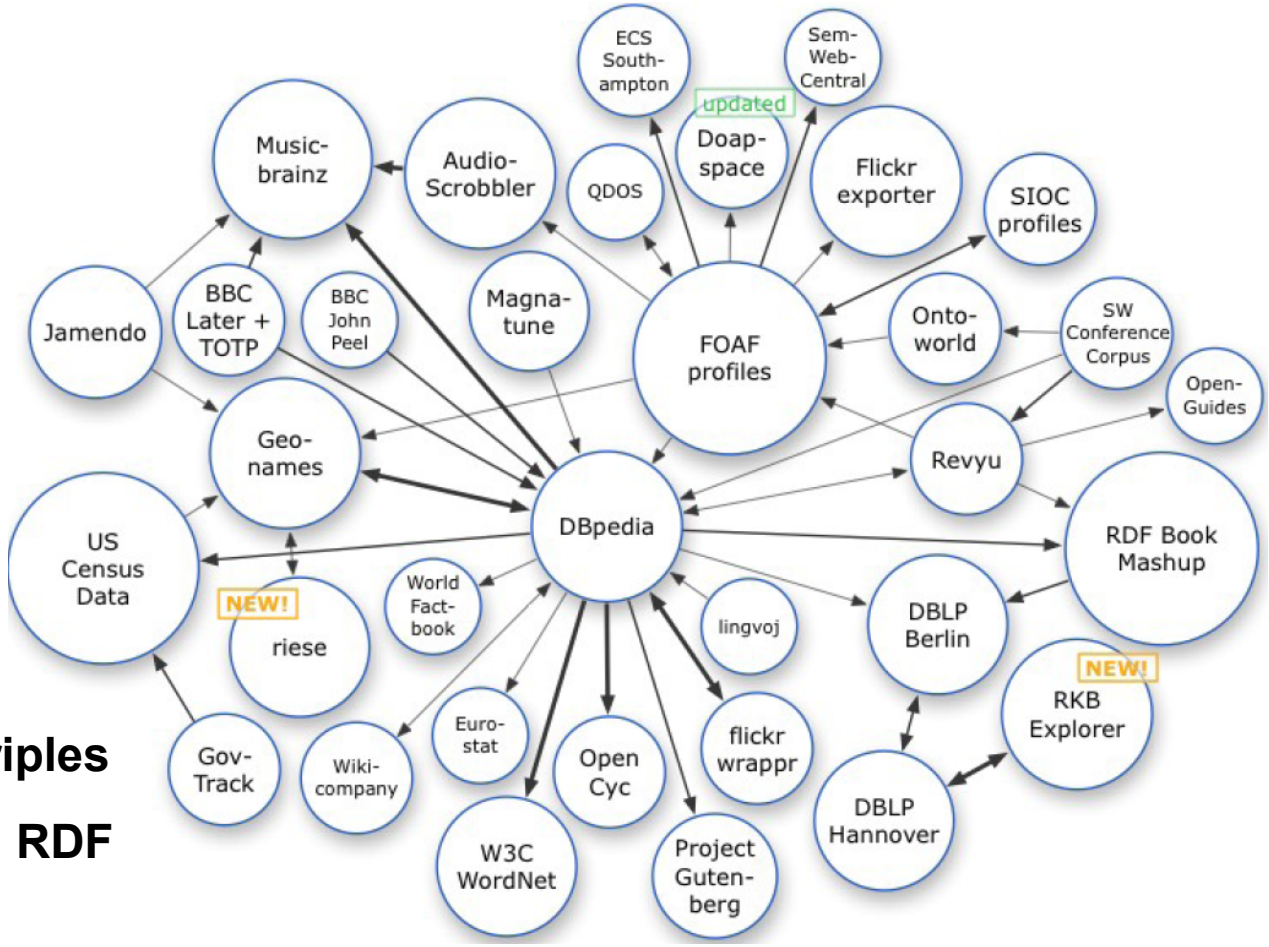
Bubbles in May 2007



Over 500M RDF triples

Around 120K RDF links between data sources

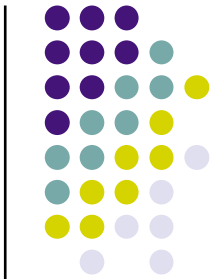
Bubbles in April 2008



>2B RDF triples

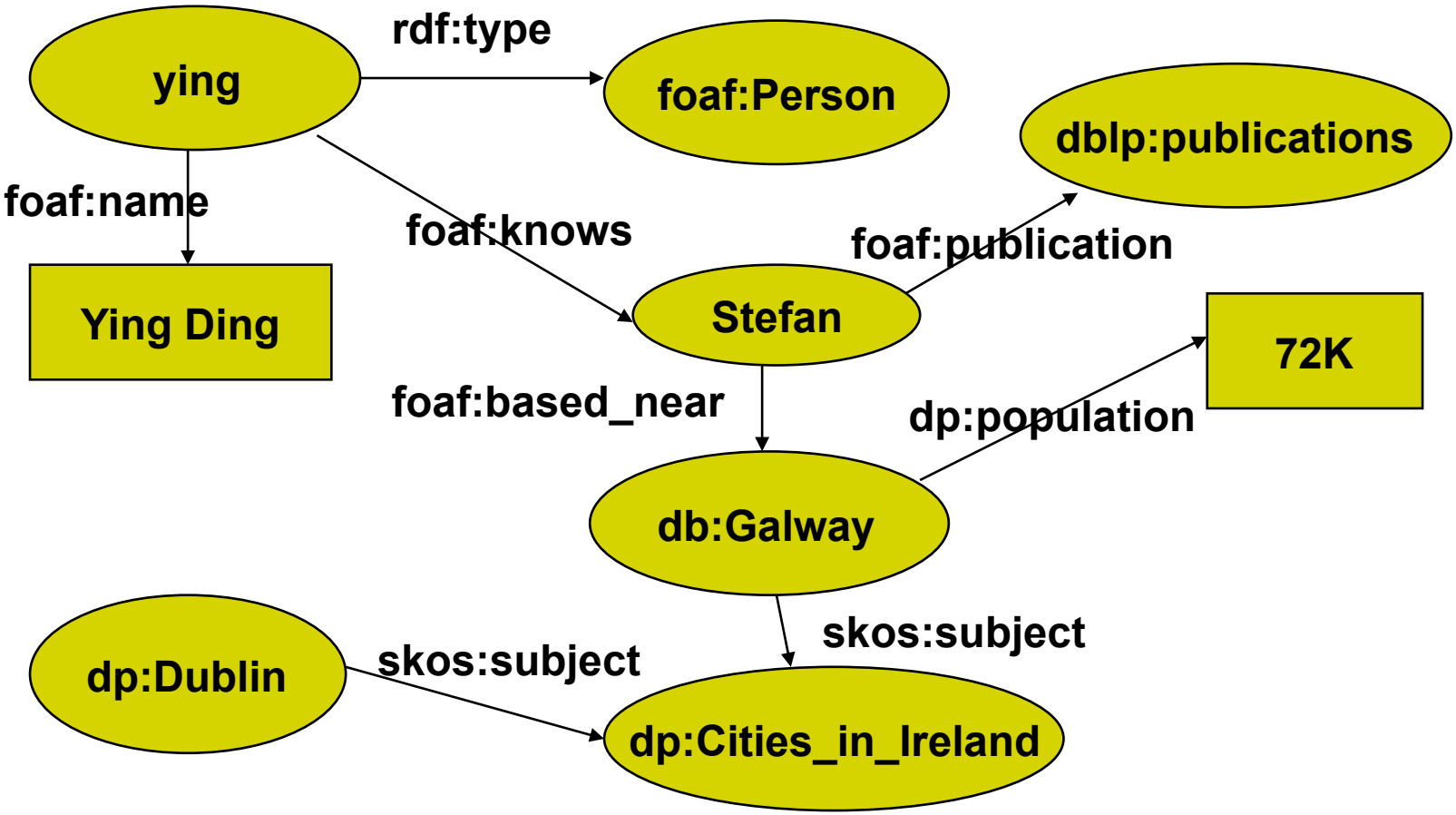
Around 3M RDF links

Organization participating in the LOD community

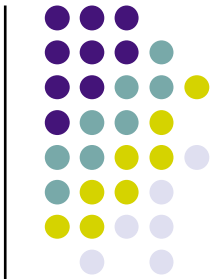


- Academic
  - MIT, Univ Southampton, DERI, Open Univ, Univ London, Univ Hannover, Penn State Univ, Univ Leipzig, Univ Karlsruhe, Joanneum (AT), Free Univ Berlin, Cyc, SouthEast Univ (CN), …
- Commercial
  - BBC, OpenLink, Talis, Zitgist, Garlik, Mondeca, Renault, Boad Interactive

Power of Linked Data

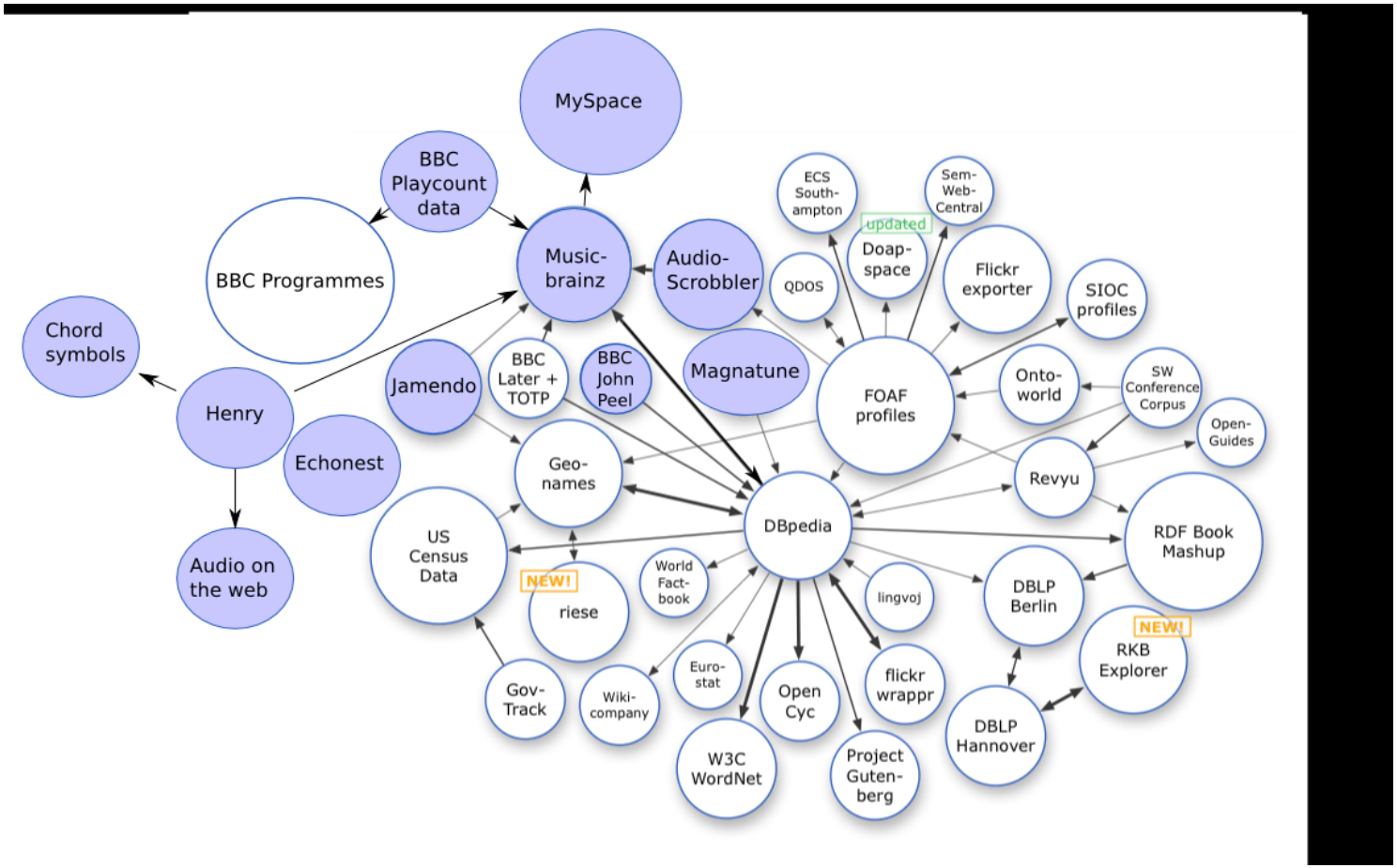


What LOD can bring?

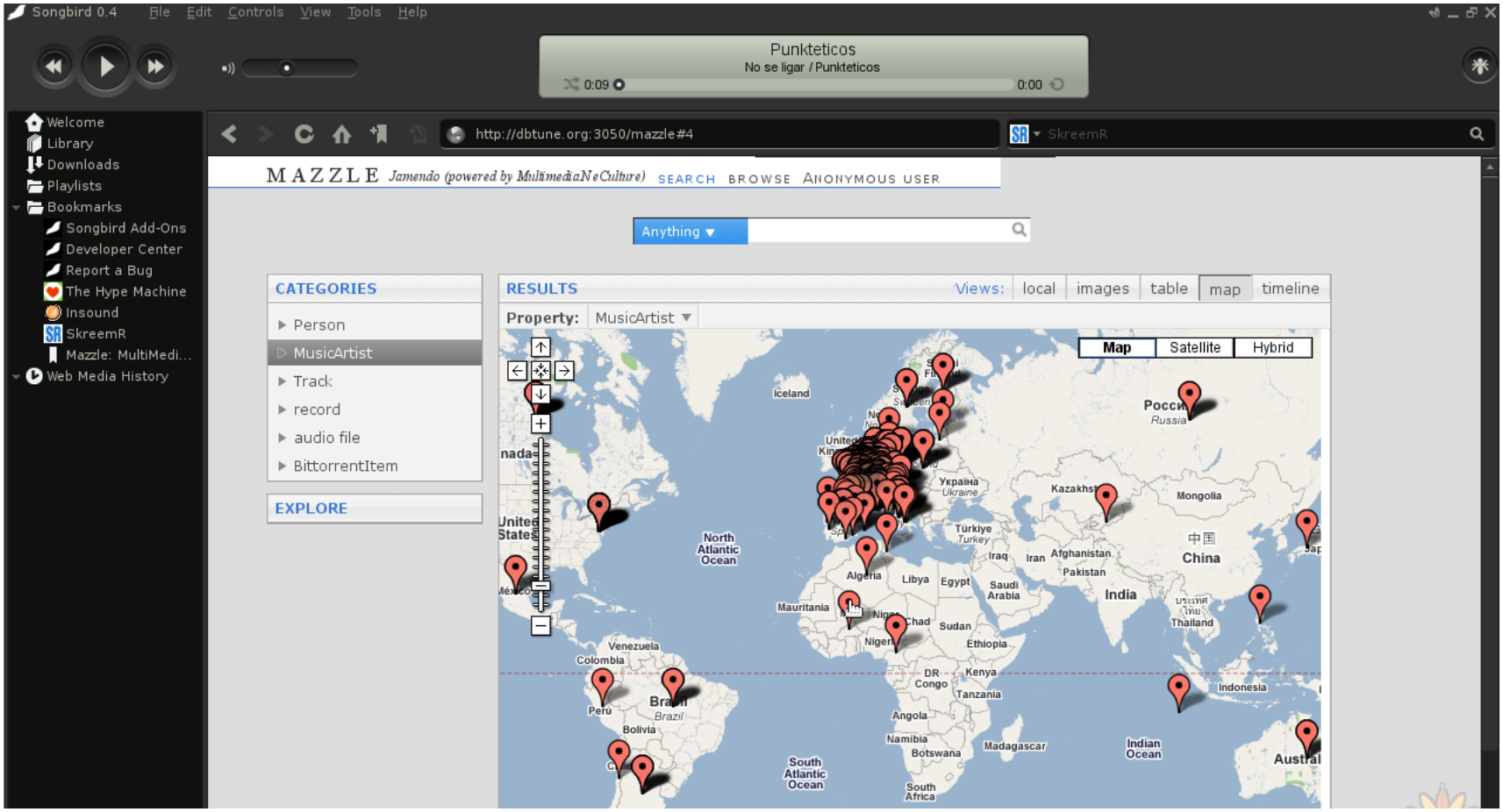


- It will lift current document web up to a data web
- LOD browsers can let you navigate between different data sources by following RDF links.
- It can drill down to the lower granularity of the information
  - allowing you for more fine search on the web
  - making the question-answer search on the Web possible
  - meshing up different data through RDF links
  - Making the built-on-top application easier

DBTune (http://dbtune.org)



DBTune


Songbird 0.4
File Edit Controls View Tools Help
Punkteticos
No se ligar / Punkteticos
0:09
0:00
Welcome
Library
Downloads
Playlists
Bookmarks
Songbird Add-Ons
Developer Center
Report a Bug
The Hype Machine
Insound
SkreemR
Mazzle: MultiMedi...
Web Media History
http://dbtune.org:3050/mazzle#4
SkreemR
MAZZLE Jamendo (powered by MultimediaNeCulture) SEARCH BROWSE ANONYMOUS USER
Anything
CATEGORIES
Person
MusicArtist
Track
record
audio file
BittorrentItem
EXPLORE
RESULTS
Views: local images table map timeline
Property: MusicArtist
Map Satellite Hybrid
Iceland
Россия
Russia
Україна
Ukraine
Kazakhstan
Mongolia
China
India
Türkiye
Turkey
Iraq
Iran
Afghanistan
Pakistan
Algeria
Libya
Egypt
Saudi Arabia
Mauritania
Niger
Chad
Sudan
Ethiopia
Nigeria
Venezuela
Colombia
Peru
Brazil
Bolivia
DR Congo
Kenya
Tanzania
Angola
Namibia
Botswana
Madagascar
South Africa
North Atlantic Ocean
South Atlantic Ocean
Indian Ocean
Thailand
Indonesia

Industry pick-up

Semantic Arts

Celtx

Digital Harbor

Aduna

Semantic Universe

empolis

Cambridge Semantics

Cycorp

Smartlogic

Mondeca

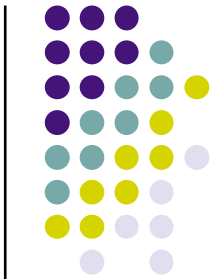
Talis

Expert System

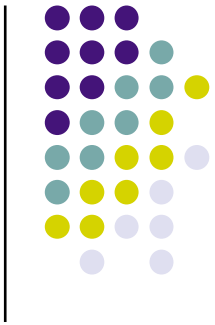
Ontotext

Semantic Insights

Industry pick-up

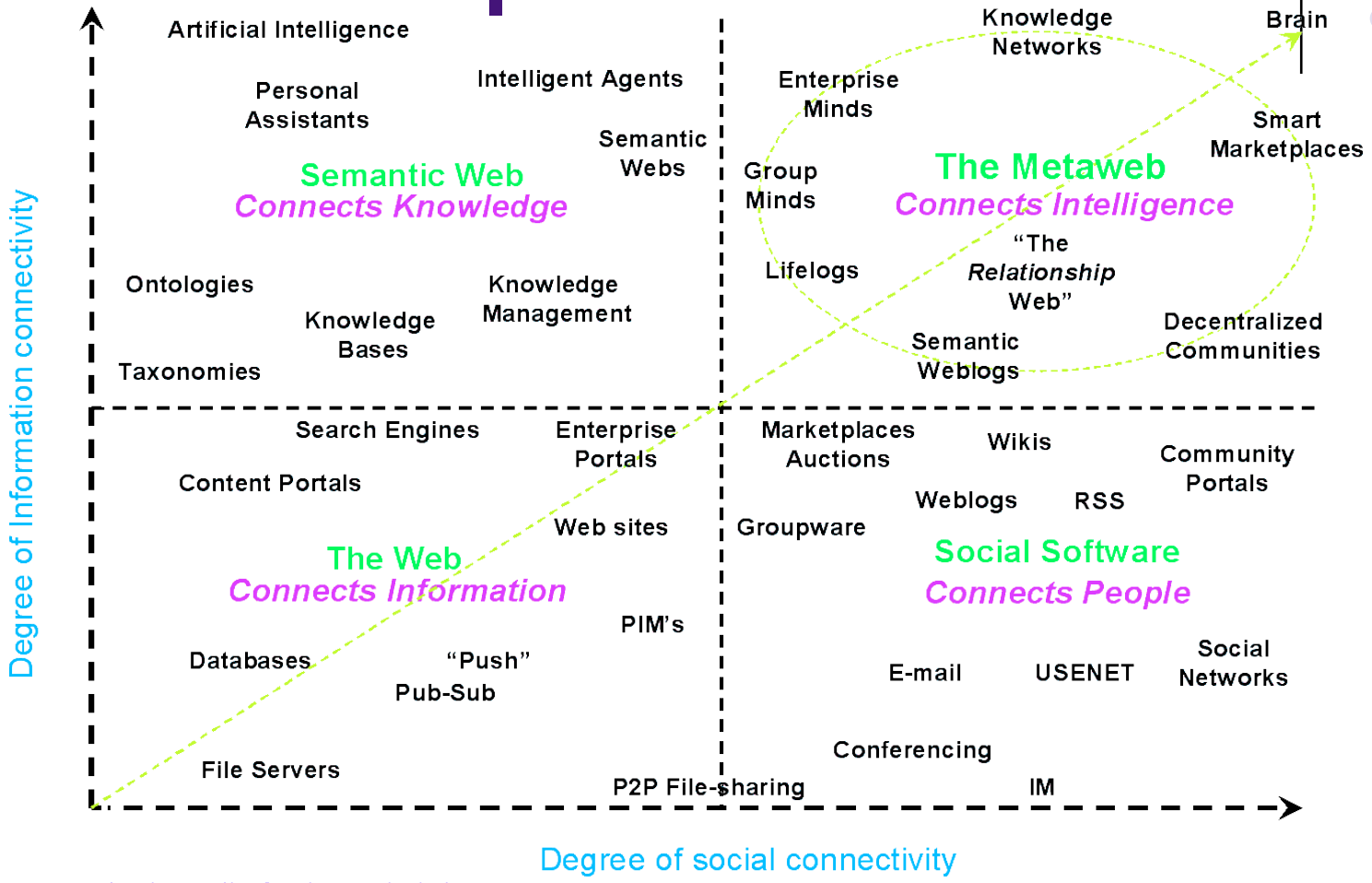


- Semantic Technology Conferences – The major industrial conference in semantic web area.
  - Attendance include major IT giants (Google, Yahoo, IBM, Oracle, Intel, Vulcan
- Rader Networks Company raised $18M to implement semantics
  - Twine (a collective semantic knowledge space): http://www.twine.com/



Semantic Web: Future

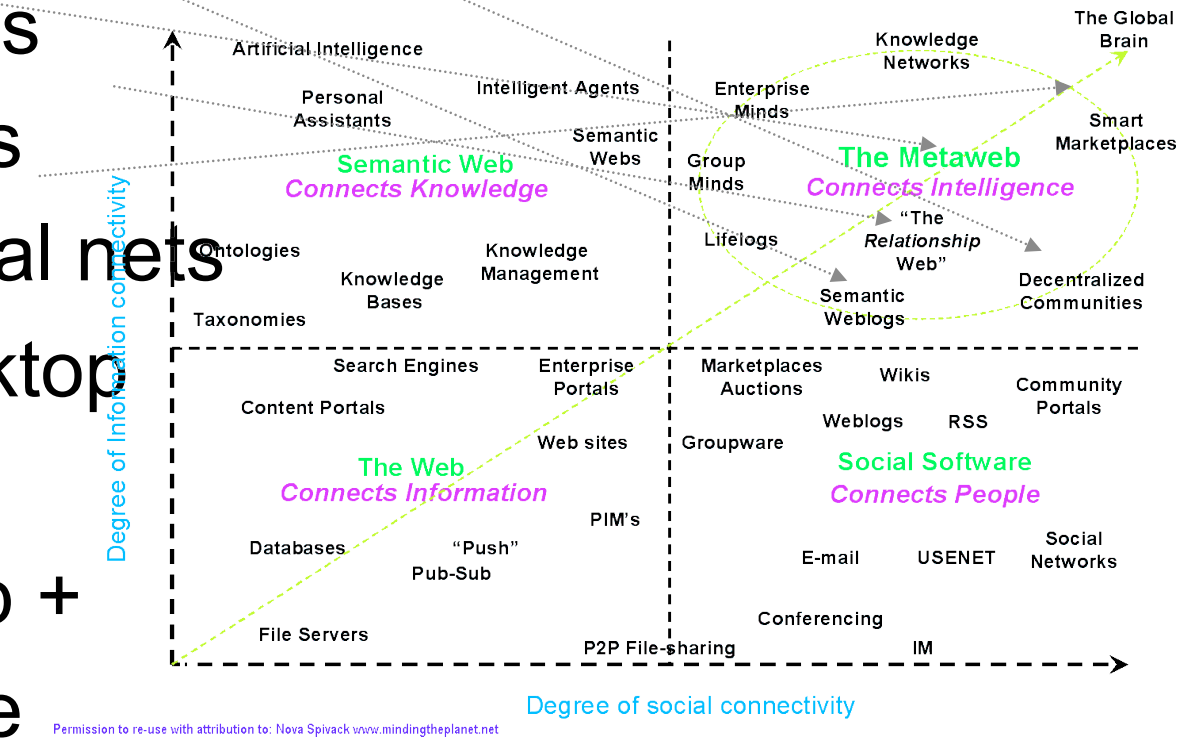
Metaweb ≡ social semantic information spaces



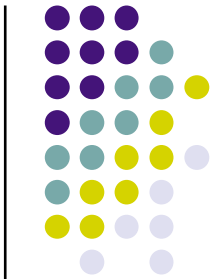
1+1>2

- Semantic forums
- Semantic blogs
- Semantic wikis
- Semantic social nets
- Semantic desktops

Semantic Web + social software

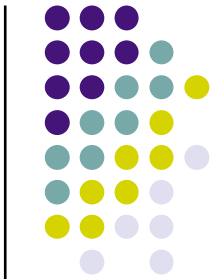


The path to Web 3.0 (the Semantic Web)



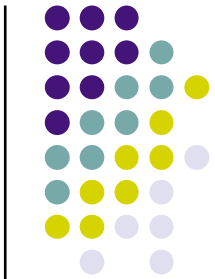
- The Semantic Web effort is mainly towards producing standards and recommendations that will **interlink data and applications**
- The Web 2.0 is about **providing user applications**
- Not mutually exclusive:
  - http://www.oreillynet.com/xml/blog/2005/10/is_web_20_killing_the_semantic.html
  - With a little effort, many Web 2.0 applications can and do use Semantic Web technologies to great benefit

Document Web vs. Data Web



- Document Web
  - Glued by hyperlinks
  - Data are HTML pages
  - Query result is HTML pages, which can not be further processed
  - Data are just interlinked, but not integrated
  - Data access through different APIs
- Data Web
  - Glued by RDF links
  - Data are RDF triples
  - Query result is RDF triples which can be easily further processed (e.g., web services)
  - Data are interlinked and integrated, and links are typed
  - Data access through a single and standardized access mechanism (maybe it will called in the future LOD API?)

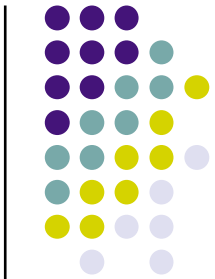
Web 3.0



Social Web + Semantic Web → Next generation Web

Document Web → Data Web → Service Web

Will Google 2.0 be Semantic?

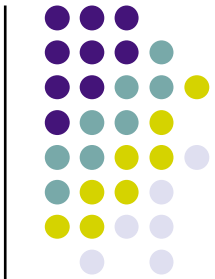


- Google could be superseded, says web inventor:
  - TimesOnline:

    http://technology.timesonline.co.uk/tol/news/tech_and_web/article3532832.ece
- Google 2.0 embraces Semantic Web
  - Government Computer News:

    http://www.gcn.com/online/vol1_no1/44290-1.html#

Thanks



- Contact
- Ying Ding
- LI029
- (812) 855 5388
- dingying@indiana.edu