

Sematic Web and ontology

CS464

Prof. Abeer ElKorany

*Faculty Of Computers and Artificial
intelligence*

Cairo University

a.korani@fci-cu.edu.eg

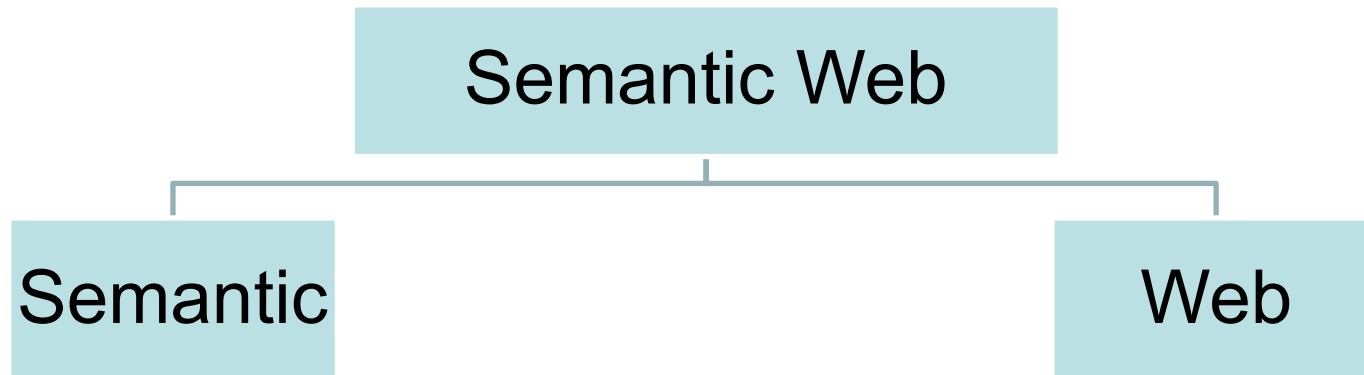
Course Overview

- Introduction to Semantic Web
- Knowledge Representation
- Rule-based systems
- Ontology Engineering
- Developing ontology using protégé
- Semantic web languages
- RDF
- OWL
- SPARQL
- Linked Data & Knowledge Graph

Semantic Computing

Phil Sheu in ICSC2007 cfp described it as:

"The field Semantic Computing applies technologies in natural language processing, data and knowledge engineering, software engineering, computer systems and networks, signal processing and pattern recognition, and any combination of the above to extract, access, transform and synthesize the semantics (contents) of multimedia, texts, services and structured data."



What is the Semantic Web?

- Providing common machine-readable framework that allows data to be shared and reused across application, enterprise, and community boundaries
- Allowing machines to understand data
- Ease sharing and mixing data
- Extend the World Wide Web rather than replace it

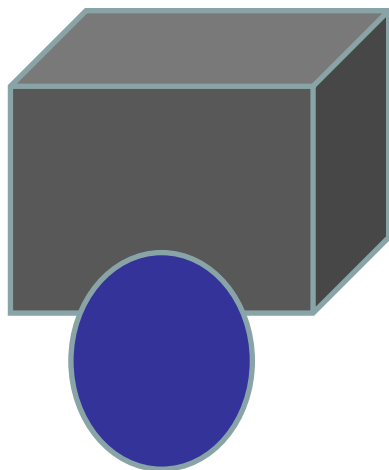
The Semantic Web is a web of data

What is the Semantic

Semantics is defined as that part of linguistics that deals with meaning

! word meaning

! sentence meaning



Consider:

! The small blue circle is in front of the square.

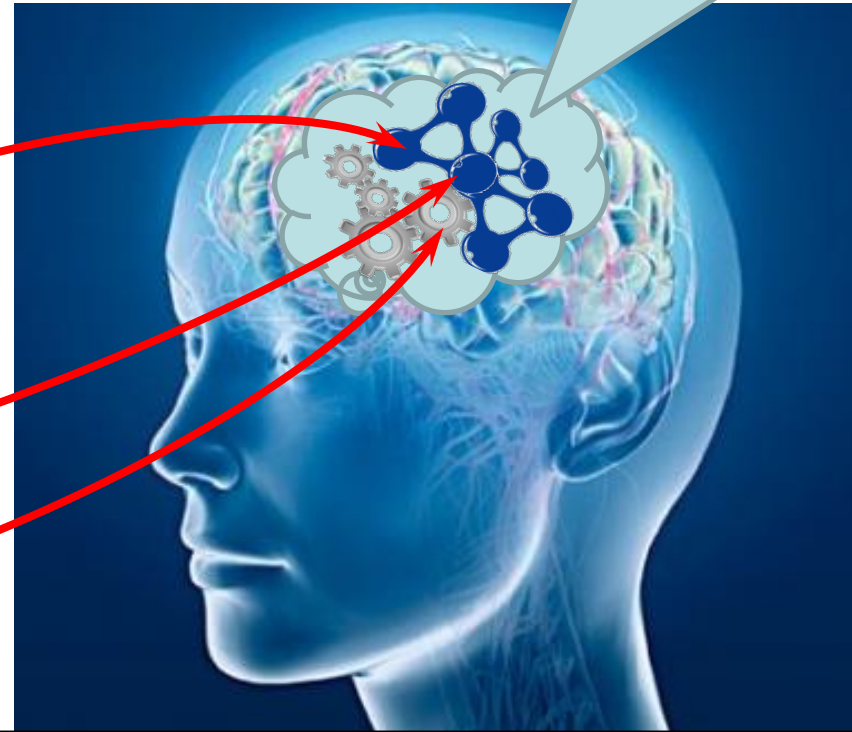
! The square is behind the small blue circle.

Content understanding

Content to be learned

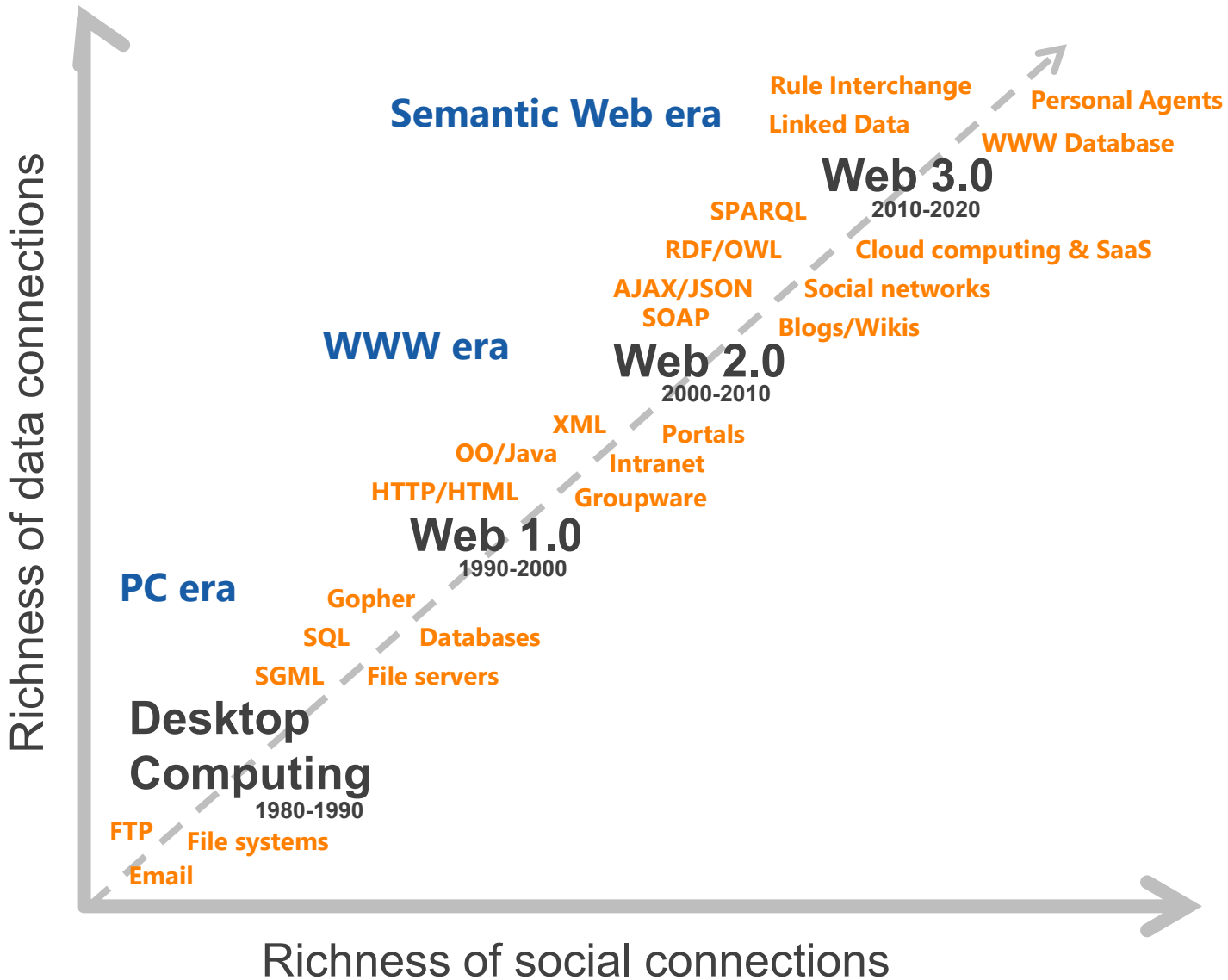


Own content: personal knowledge and skills



Understanding: the process of connecting (linking) the conceptual items of new knowledge and skills coming from external sources to the ones already stored as a personal knowledge and skills. Linked Data (emergent and challenging concept of Tim Berners Lee widely exploited by the Semantic Web community) is the good analogy and possible enabling technology for the content understanding.

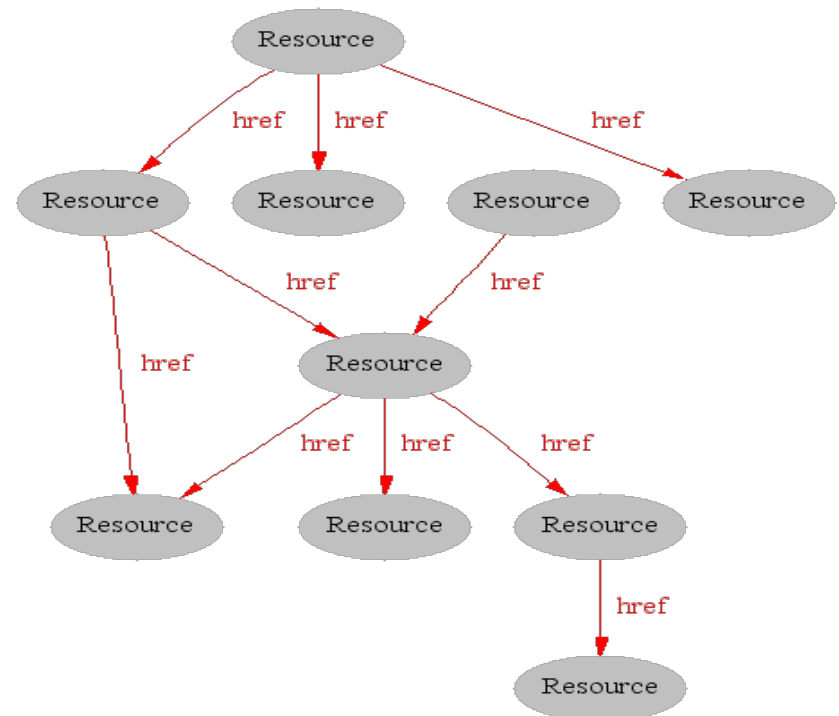
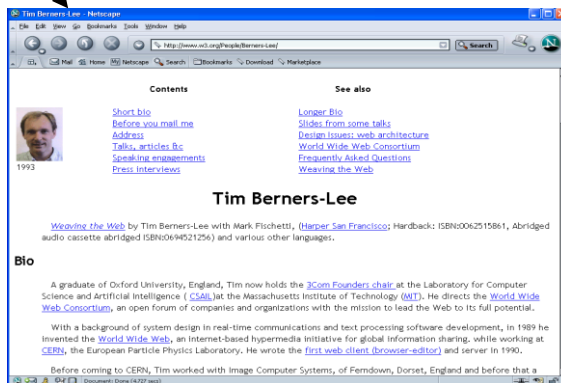
Evolution of World Wide Web



WWW: Basic Ideas

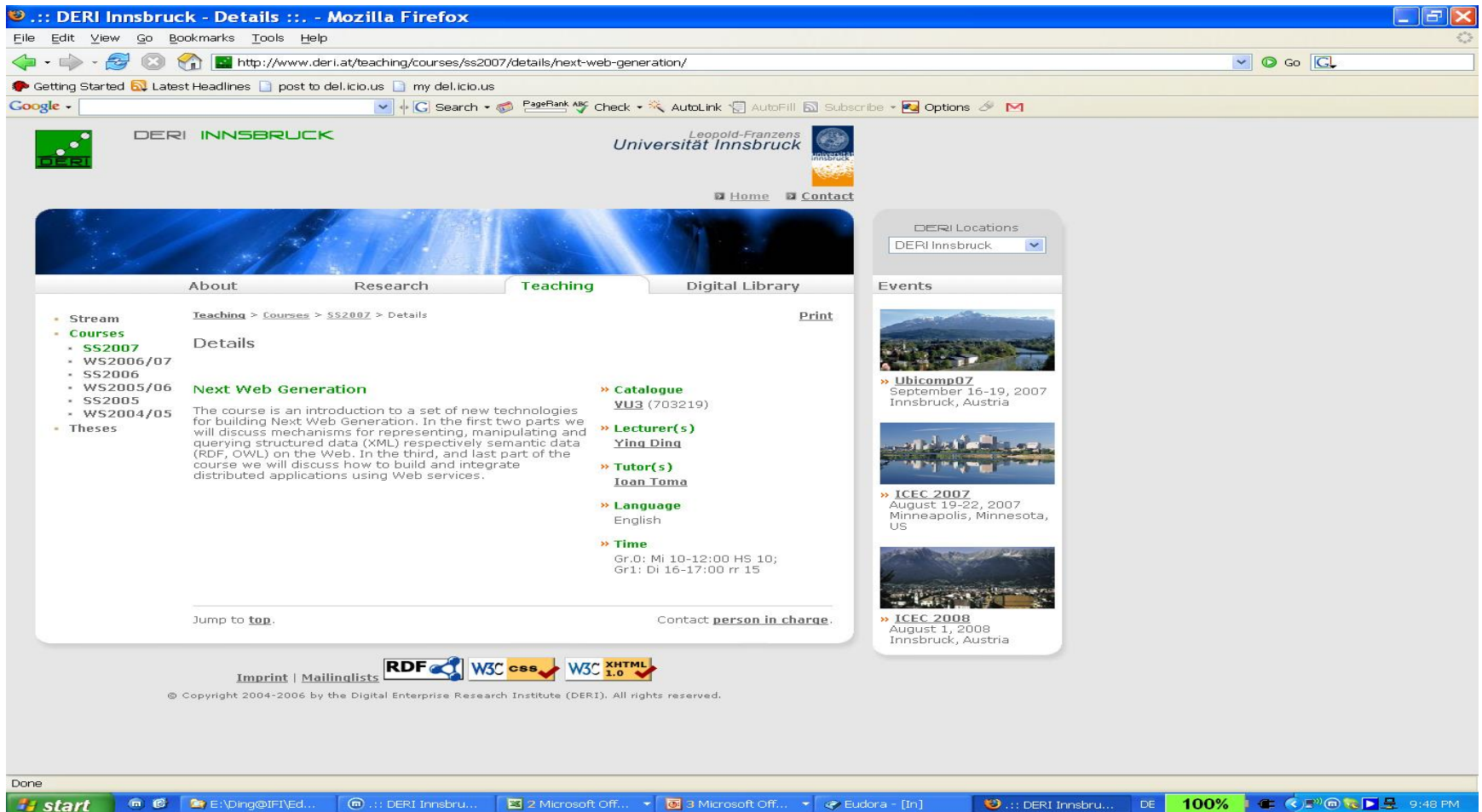
- Hypertext/hyperlink:
- Resource Identifiers
 - unique identifiers used to locate a particular resource (computer file, document or other resource) on the network
 - URI (Uniform Resource Identifier)/URL (Uniform Resource Locator): http or ftp
 - `http://somehost/absolute/URI/with/absolute/path/to/resource.txt`
 - `ftp://somehost/resource.txt`
- Markup language:
 - characters or codes embedded in text which indicate structure, semantic meaning, or advice on presentation

1- The Syntactic Web

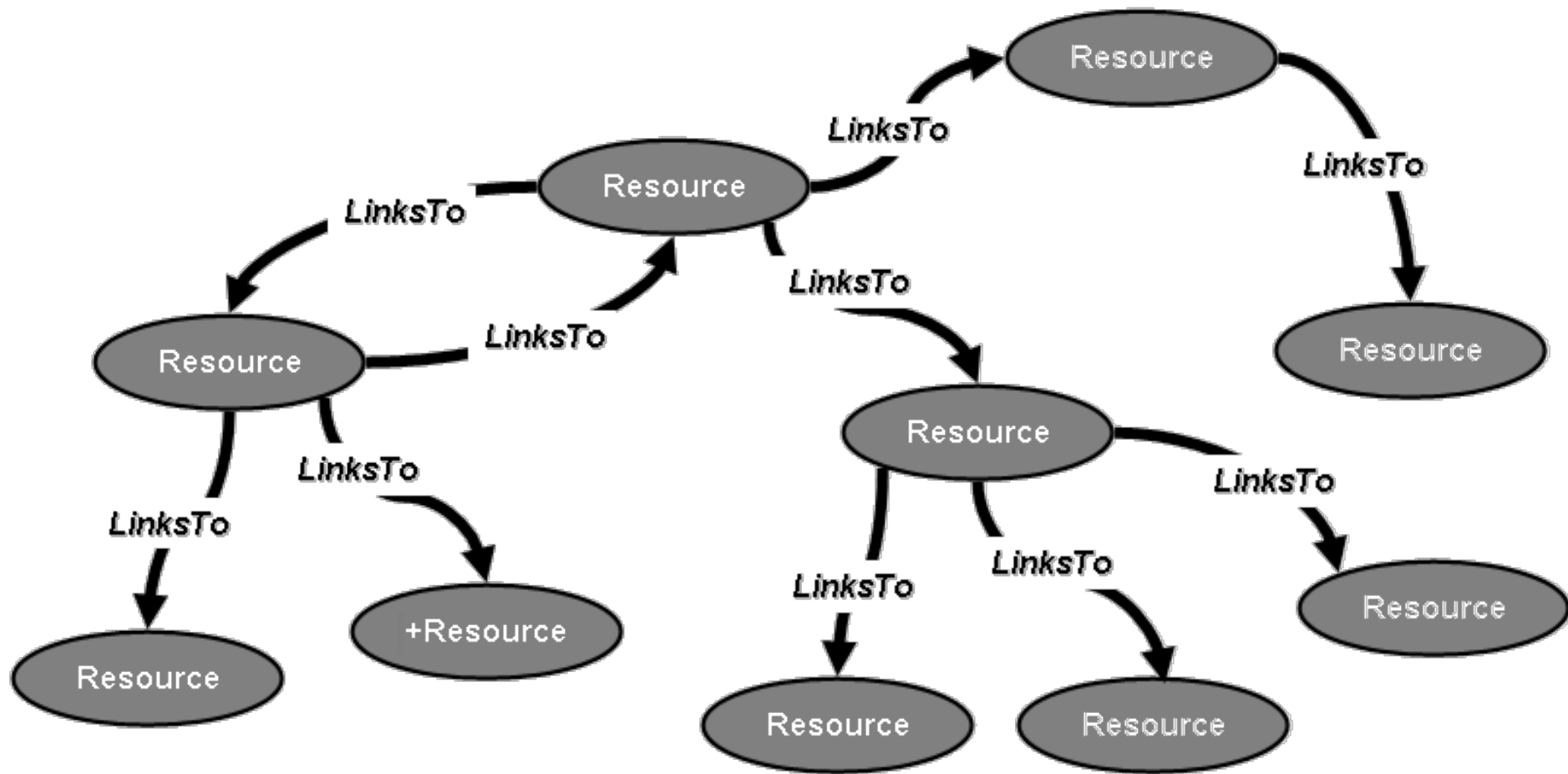


[Hendler & Miller 02]

WWW – Web 1.0



Most of the Current Web (dumb links)



Social Web – Web 2.0

- 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:
 - LinkedIn, del.icio.us, digg, Flickr, Google Maps, Skype, Wikipedia...

DSCF0831



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[mtnjohn](#) [pro](#) [says:](#)

Great capture.

Posted 18 months ago. ([permalink](#))



[Cloudie](#) [pro](#) [says:](#)

Thanks!

Posted 18 months ago. ([permalink](#))



[Campin' Guy](#) [pro](#) [says:](#)

Nice shot!! I see a lot of Yosemite picture and I can honestly say, "THIS is a nice

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sioc-project.org | Semantically-Interlinked Online Communities

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Semantically-Interlinked Online Communities

by Cloudie to [sioc](#) [semanticweb](#) [distributedconversations](#) [rdf](#) [unifiedcommunities](#) [virtualforums](#) [blogs](#) [forums](#) [mailinglists](#) [users](#) ... on oct 04

user notes

Jan '07

SIOC provides methods for interconnecting discussion methods such as blogs, forums and mailing lists to each other. It consists of the SIOC ontology, an open-standard machine readable format for expressing the information contained both explicitly and implicitly.

- [fhasi897](#)

Oh, and here's some of my original idea for sparrow, which was just an end-run around the whole semantic web bullshit. These guys seem to be wallowing in the semantic web bullshit, though.

- [fweez](#)

Dec '06

common tags

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Motivation for Semantic Web

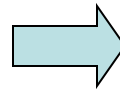
Web Limitations

Average WWW searches examine only about 25% of potentially relevant sites and return a lot of unwanted information

Doubles in size every six months

World Wide Web

Information on web is not suitable for software agents

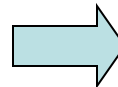
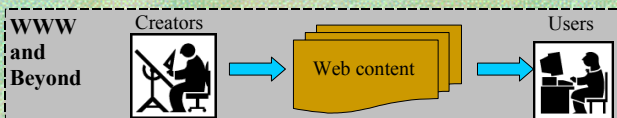


Semantic Web

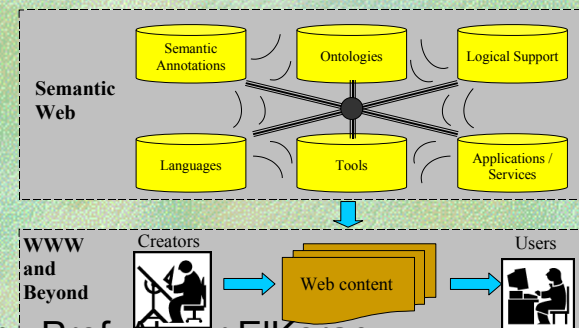
The Semantic Web is a vision: the idea of having data on the Web defined and linked in a way that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications.



Before Semantic Web



Semantic Web Structure



What is the Semantic Web?

- Web was “invented” by **Tim Berners-Lee** (amongst others), a physicist working at CERN (European Organization for Nuclear Research)
- His vision of the Web was much more ambitious than the reality of the existing (syntactic) Web:



“... a set of **connected applications** ... forming a **consistent logical web of data** ...”

“... an extension of the current web in which information is given **well-defined meaning**, better enabling computers and people to work in **cooperation** ...”

Web of machine-readable data

Approach: Semantic Web

“The Semantic Web is a vision: the idea of having data on the Web defined and linked in a way that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications”



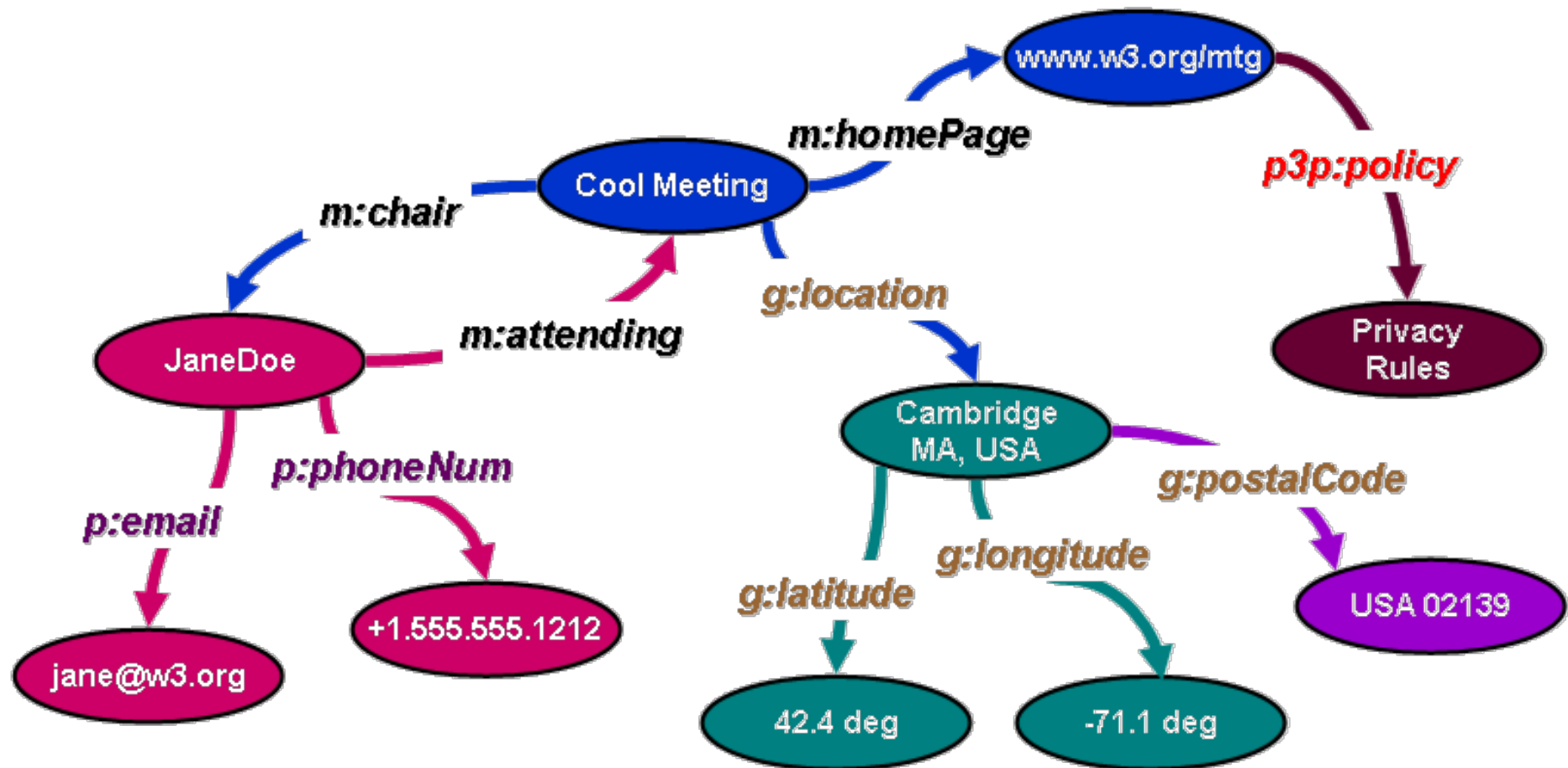
<http://www.w3.org/sw/>



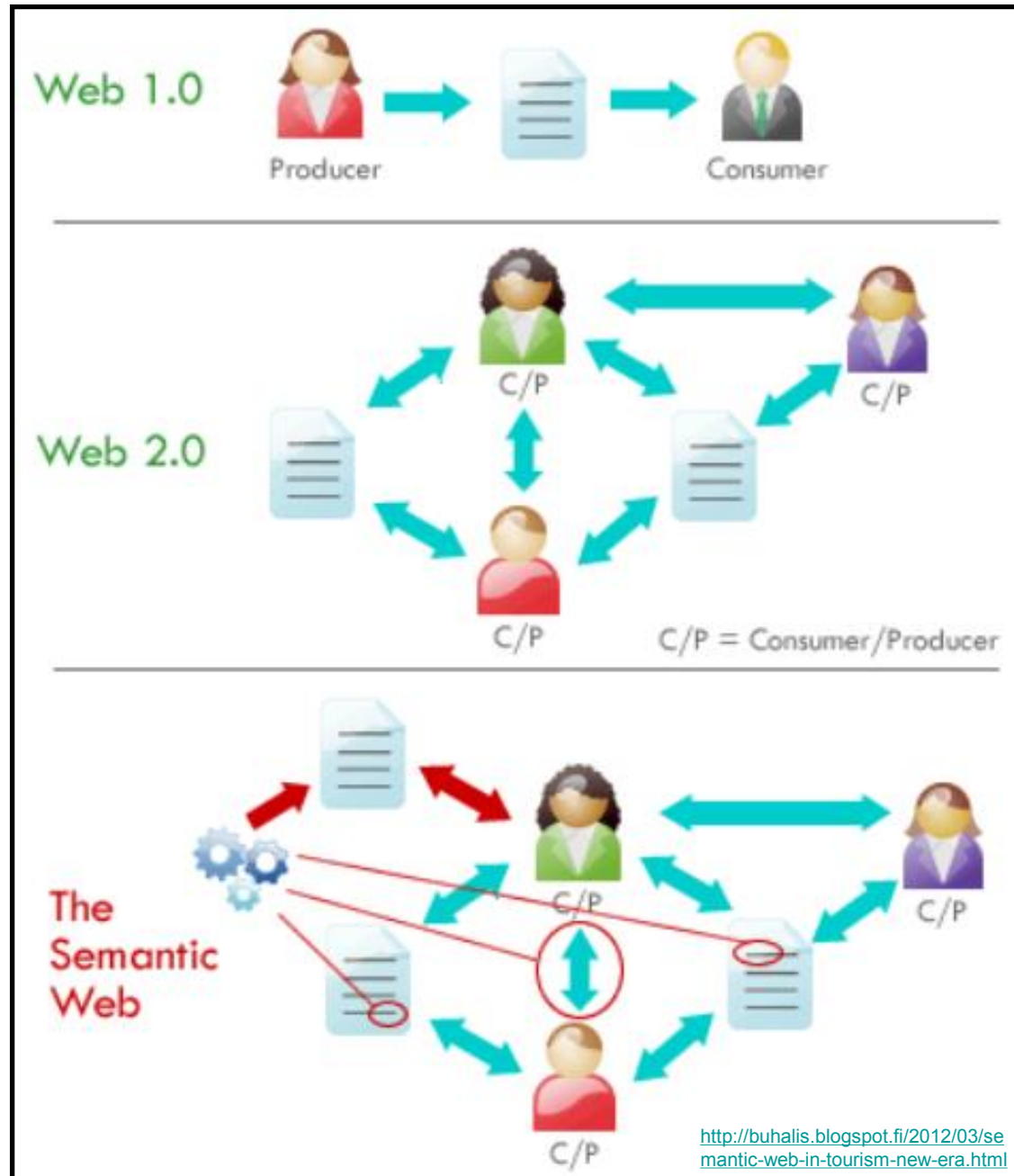
The Semantic Web is an initiative with the goal of extending the current Web and facilitating Web automation, universally accessible web resources, and the 'Web of Trust', providing a universally accessible platform that allows data to be shared and processed by automated tools as well as by people.

Semantic Web

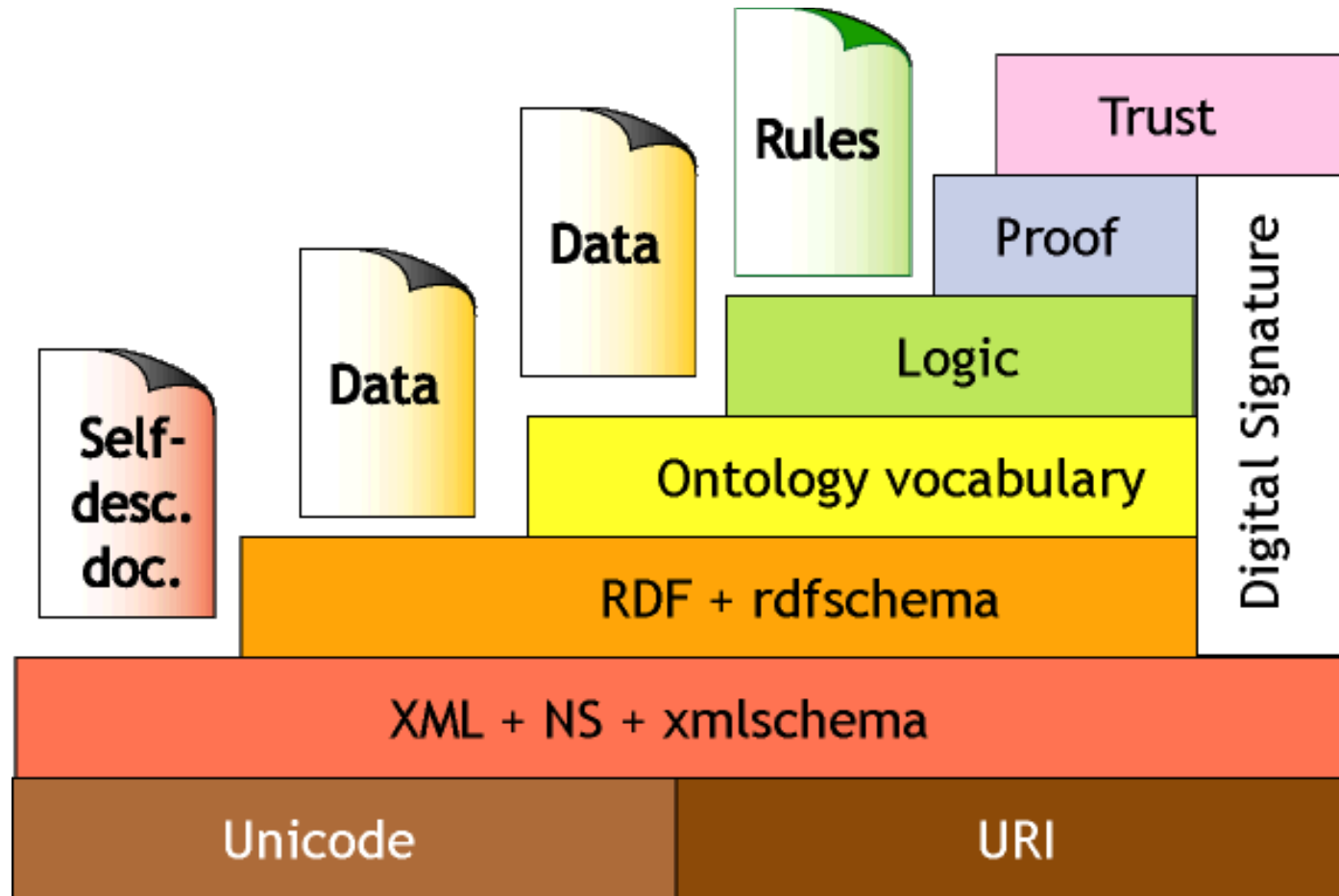
(data connected by relationships)



Semantic Web: Added Value

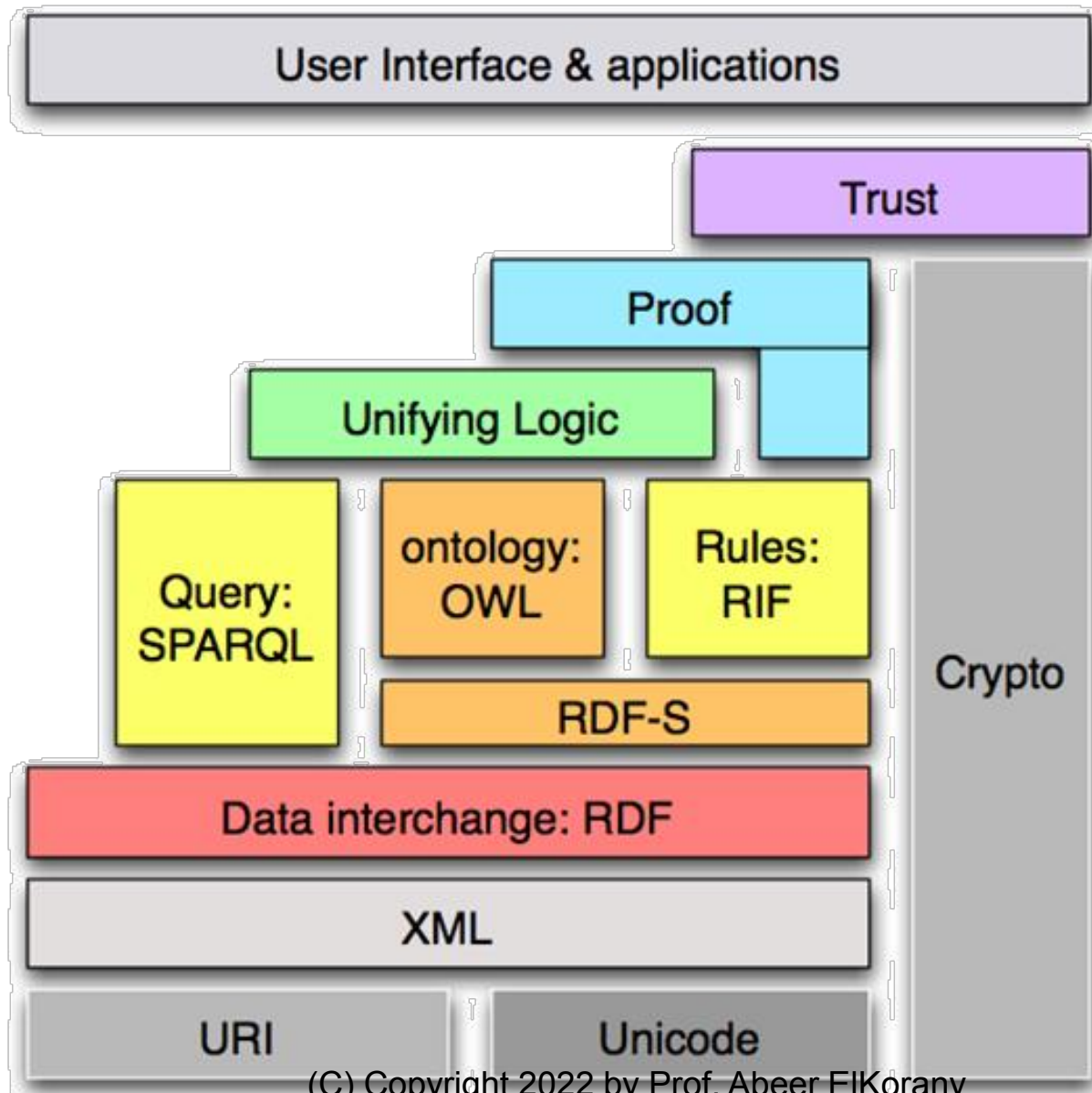


Tim Berners-Lee's Vision of Semantic Web (IJCAI-01)



Semantic Web Stack

(updated, W3C, 2006)



What is the Semantic Web?

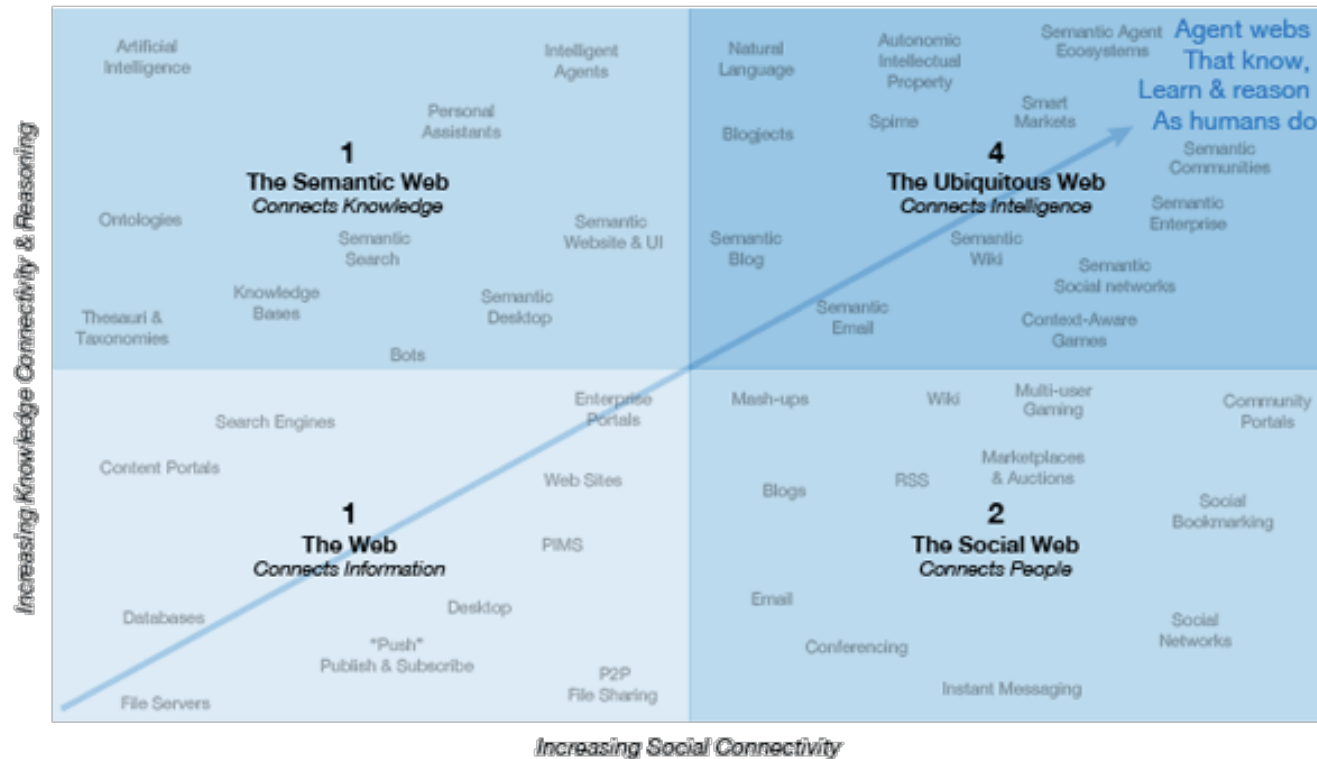
- *“An extension of the current Web in which information is given well-defined meaning, better enabling computers and people to work in cooperation.”*
 - Sir Tim Berners-Lee et al., Scientific American, 2001: tinyurl.com/i59p
- *“...allowing the Web to reach its full potential...”* with far-reaching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

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 Wave" (Web X.0)

What is the Evolution of the Internet to 2020?



Source: New Spirit, Radar Networks, John Bessly, DERI & MIT's Centre, ProjectFOX

We may add here:

Web 5.0 will come finally and it is about **connecting models** in a **"Global Understanding Environment" (GUN)**, which will be such proactive, self-managed evolutionary Semantic Web of Things, People and Abstractions where all kinds of entities can understand, interact, serve, develop and learn from each other.

[Vagan Terziyan]

"The **semantic wave** embraces four stages of internet growth:

Web 1.0, was about **connecting information** ...

Web 2.0 is about **connecting people**.

Web 3.0, is starting now... and it is about ... **connecting knowledge**...

Web 4.0 will come later ... and it is about **connecting intelligences** in a ubiquitous web where both people and things can reason and communicate together."

[**"Semantic Wave 2008"**, **Mills Davis**]

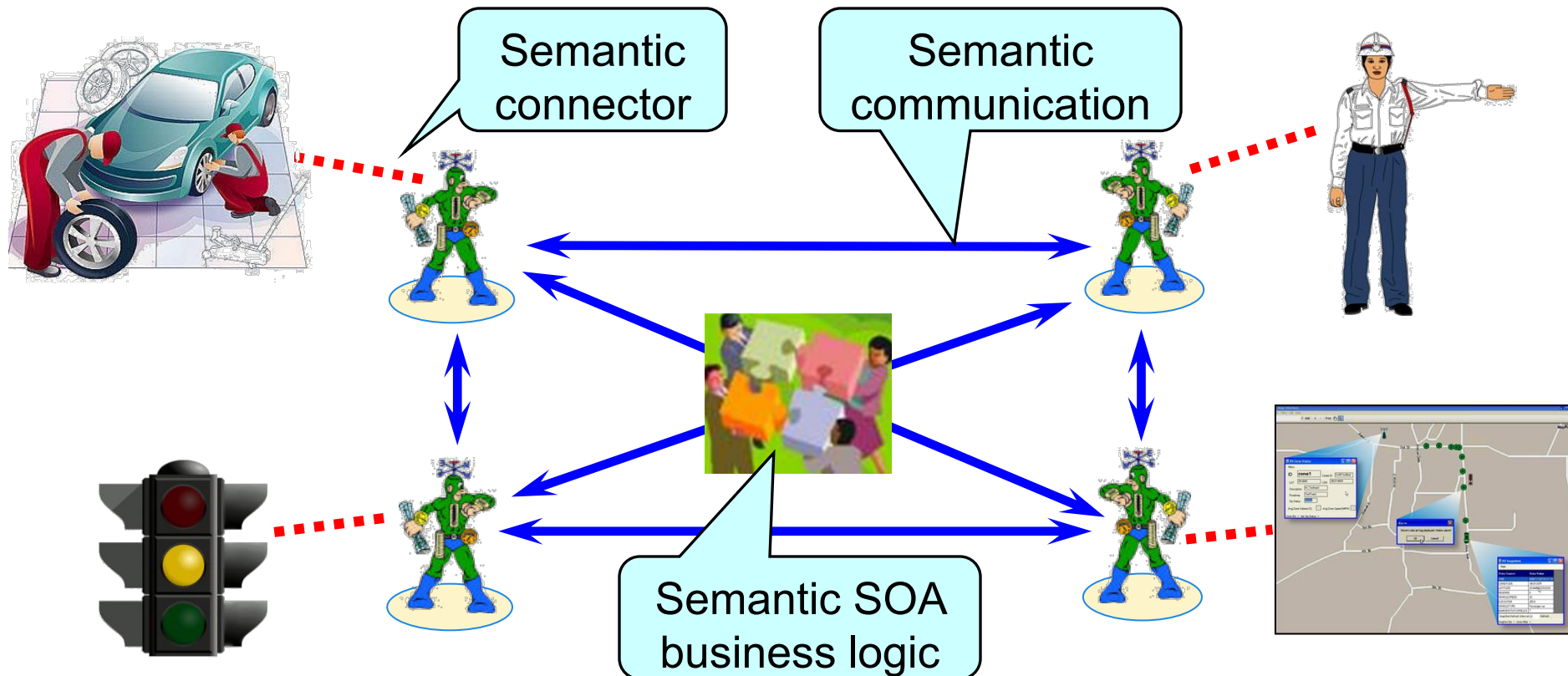
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Agents are needed ! ... and semantics is needed !

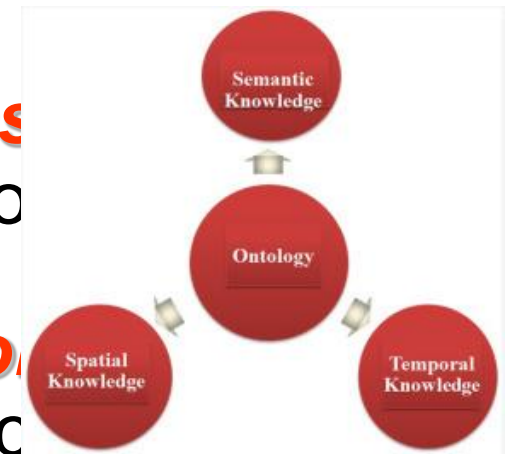
Adding a “**virtual representative**” to every resource solves the global interoperability problem. Intelligent **agent** (a kind of “software robot”) will act, communicate and collaborate on behalf of each Web resource



Ontology

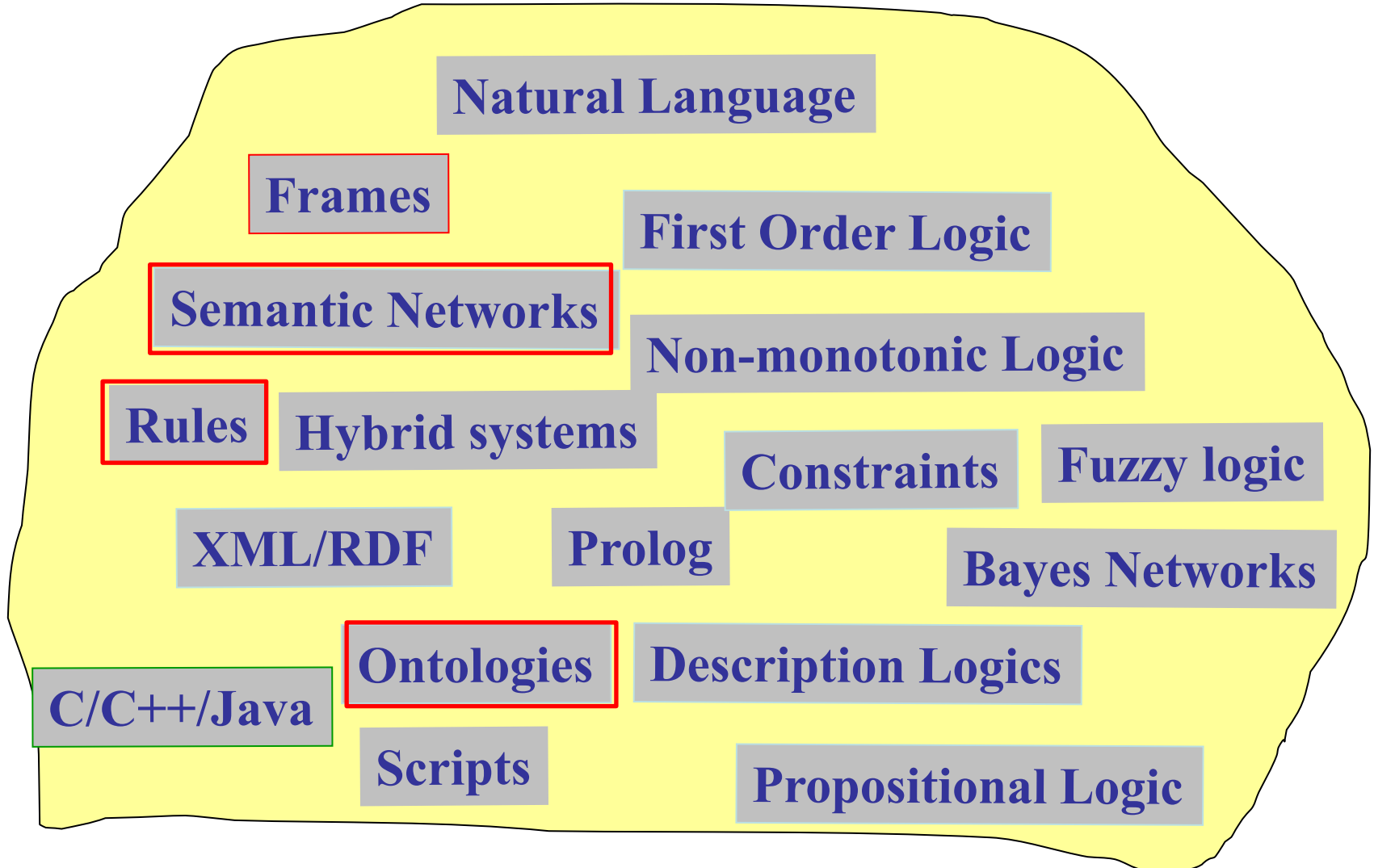
- Ontology based knowledge representation describes the individual instances and roles in the domain that are represented using unary and binary predicates*.

- **ontologies** are **formal** and **cons** specifications of conceptualization (e.g. by OO Models, or Entity Relationship model)
- providing a **shared and common** understanding of a domain that can be communicated across people and application systems



* Gayathri, R., & Uma, V. (2018). Ontology based knowledge representation technique, domain modeling languages and planners for robotic path planning: A survey. *ICT Express*, 4(2), 69-74.

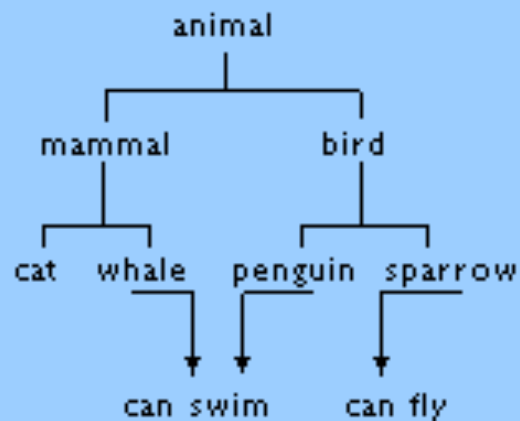
Methods of Knowledge Representation



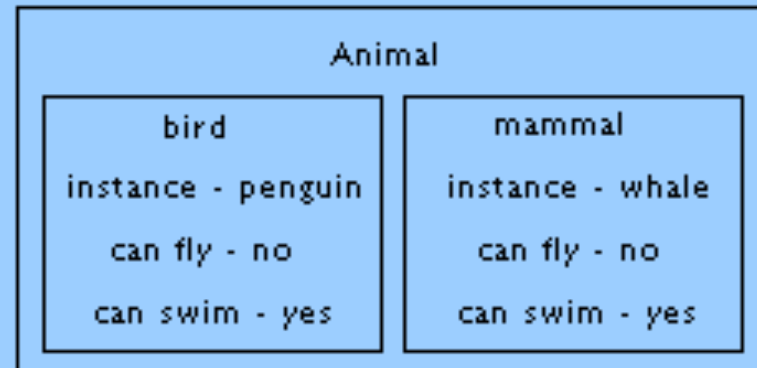
Different Knowledge representation language

STORING INFORMATION

TREE STRUCTURE



FRAME



SEMANTIC NET

