Sematic Web and ontology
CS464

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Course Overview

- **Course Description**
- **Assessment**

Guidelines and Rules

- Keep your Mobile phones silent please.
- Alert me if I went faster than you could capture the content.
- Additional bonus for impressive answers

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

References

- Antoniou, G., & Van Harmelen, F. (2012). *A **semantic web primer***. MIT press.

- Hitzler, P., Krotzsch, M., & Rudolph, S. (2009). ***Foundations of semantic web technologies***. Chapman and Hall/CRC.

Assessment 100%

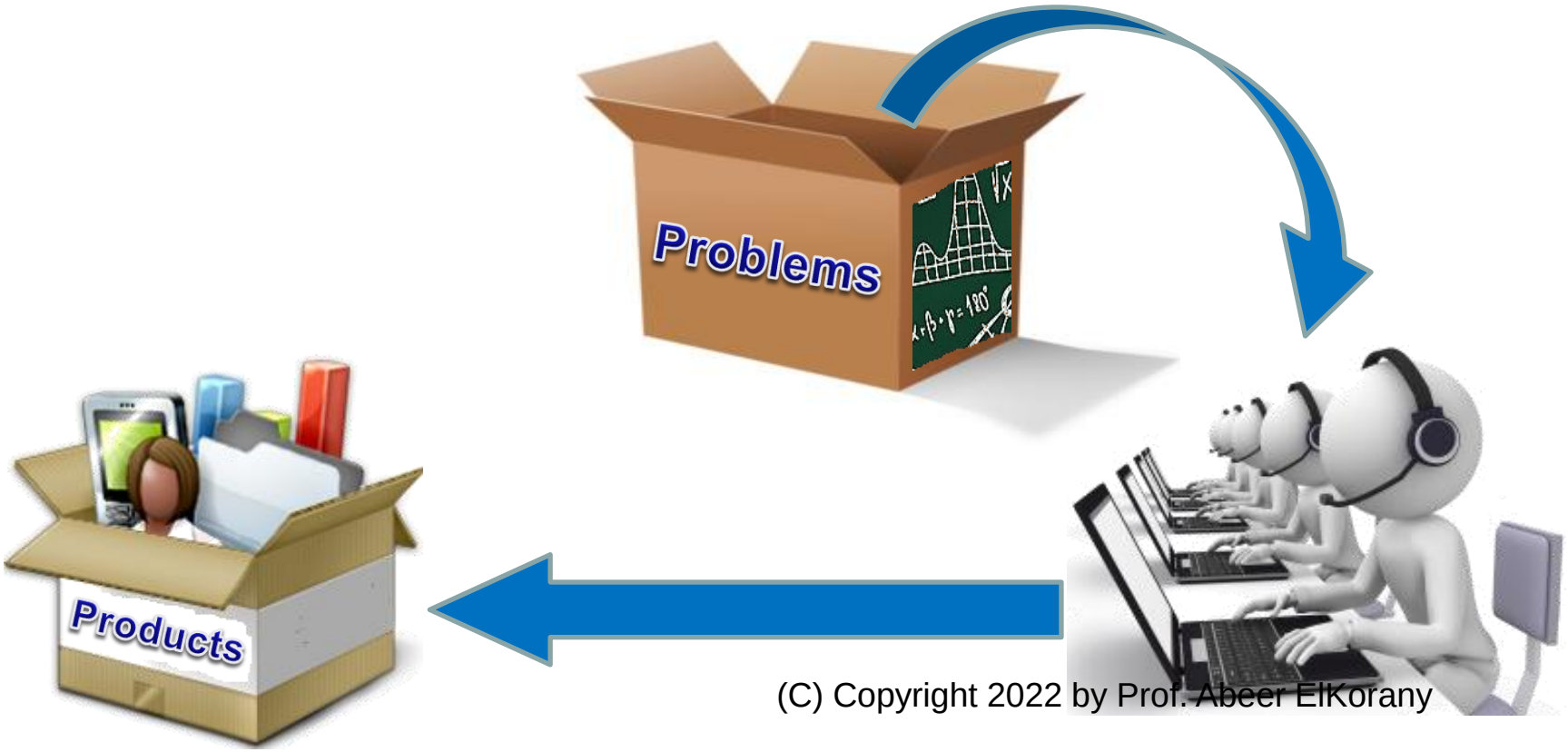
- **Grading Basis**
  - 8 % Lab-work
  - 12% Midterm
  - 10 % Assignments
  - 10% Group project
  - 60% Final
- **Late Policy**
  - No late, -20% per day for any late submission
  - Cheating policy is –ve points
- **Bonus Points**
  - Bonus questions will occasionally offered to students. I may announce other opportunities for bonus points during the course.

PLEASE !!!
Download version:
Protégé 5.5.0, CLIPS 6.4

Before We start the Academic Content

Good Engineers …

… converting problems into products

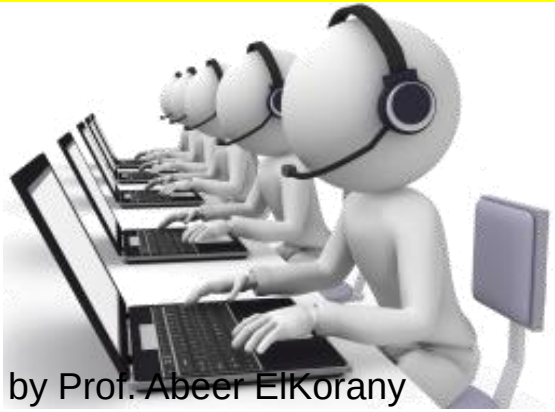


Good Engineers vs. **Managers**

… "talking" about products (buying, managing, selling)

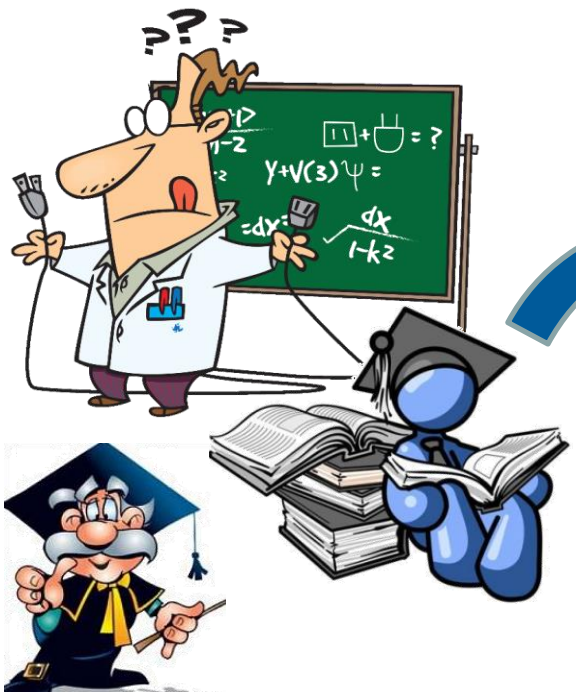
Good Engineers vs. **Advanced Users**

… installing (or API-based accessing as-a-service), administrating and using product as part of their professional activity or as a component in their applications or business processes … understanding WHAT the product is doing but without deep understanding HOW …



Good Engineers vs. VIP Engineers

… inventing new problems



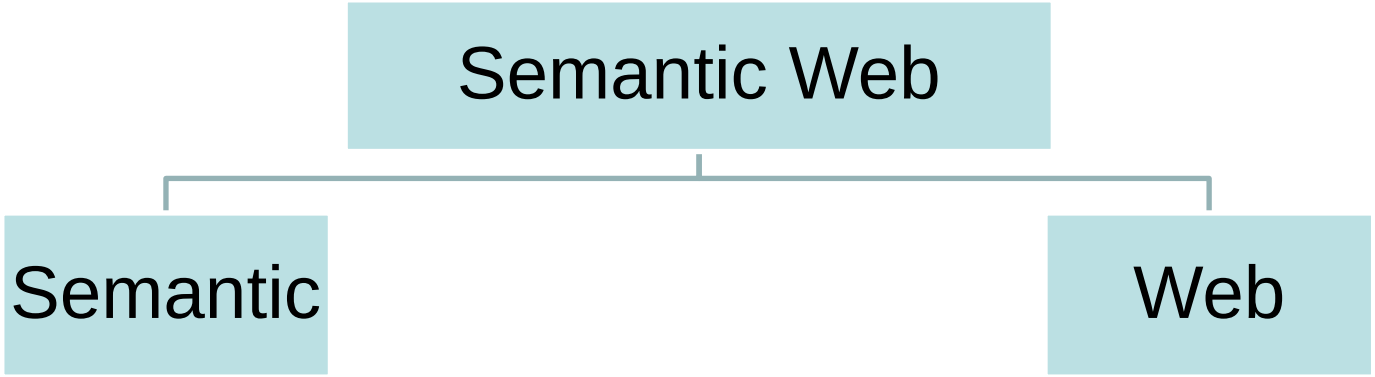
Overview of this lecture

- Introduction to Sematic Web
- Ontology and Knowledge Representation
- Semantic Technology
- Semantic (Web) Applications and Service
- Relation to Big Data and Industry 4.0.

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?

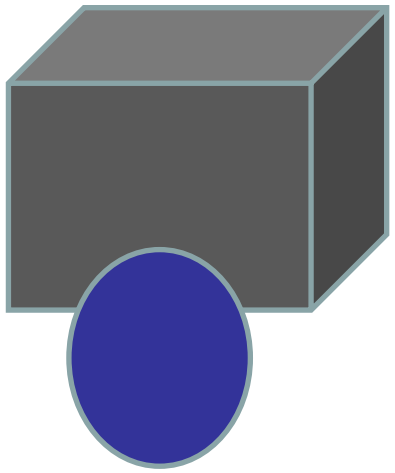
- Providing common machine-readable framework that allows data to be shared and reused across application, enterprise, and community boundaries

- 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

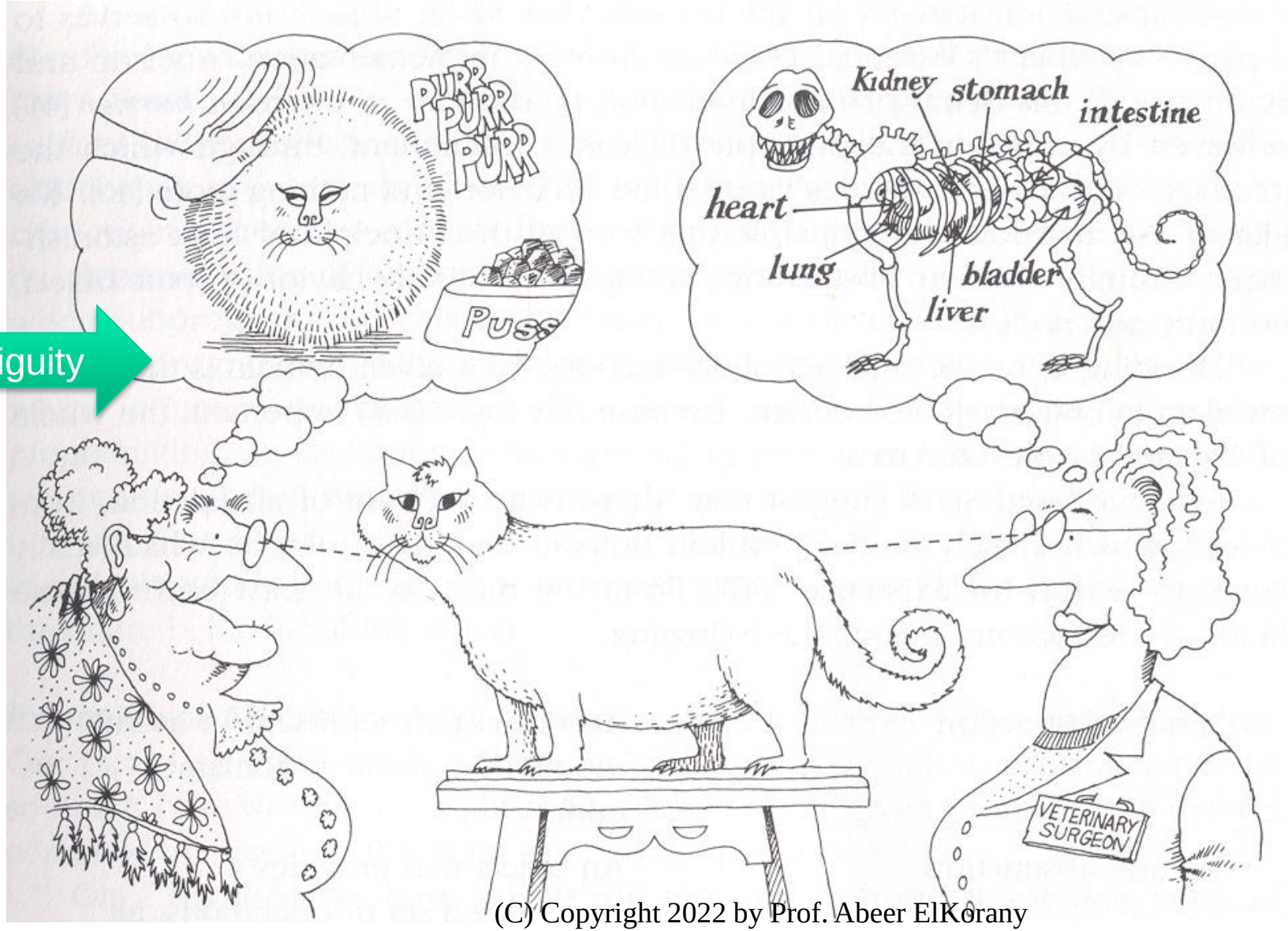
What is the Semantic

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.

Semantic is used for simplify communication between people



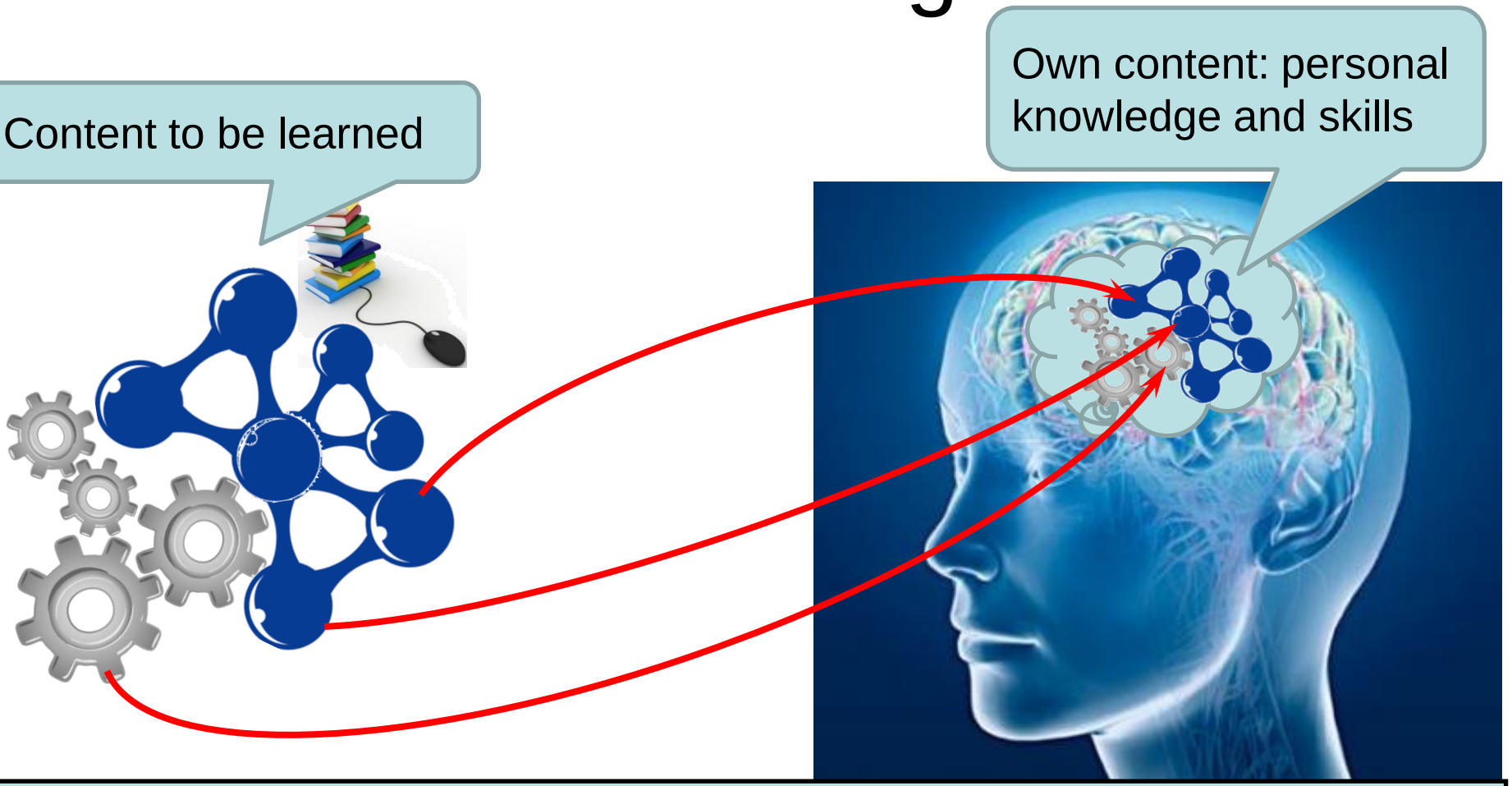
ambiguity

Semantics = meaning (from Greek)
What is understanding?

Relational understanding means a child knows what to do and can explain why.

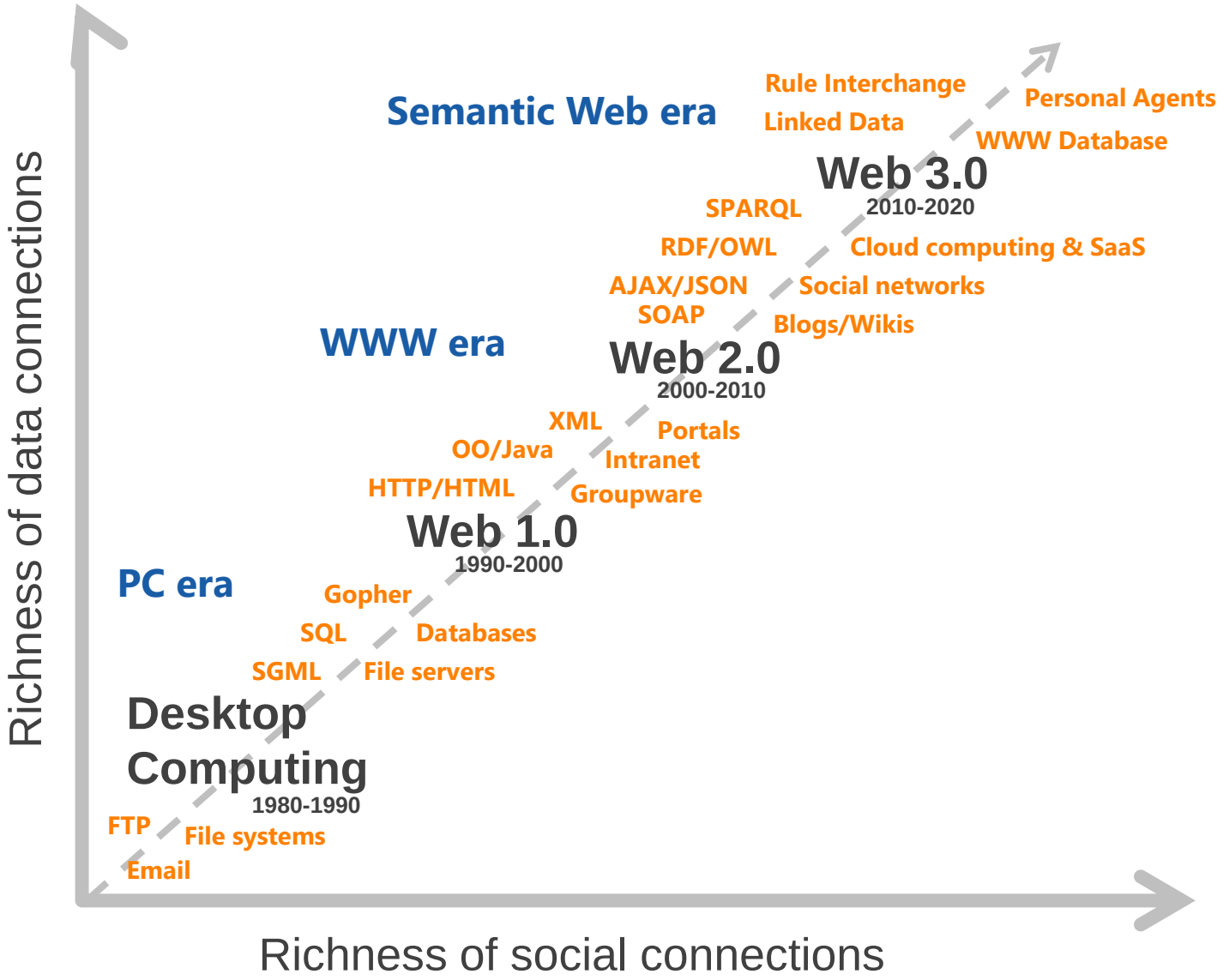
Instrumental understanding means a child knows a rule or procedure, and has the ability to use it.

Content understanding



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.

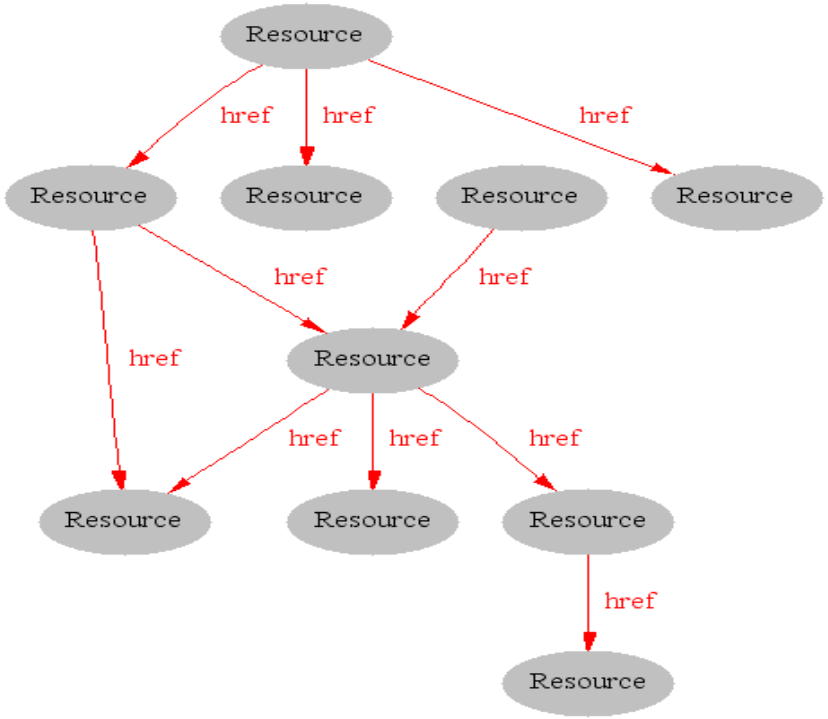
Evolution of World Wide Web



WWW: Basic Ideas

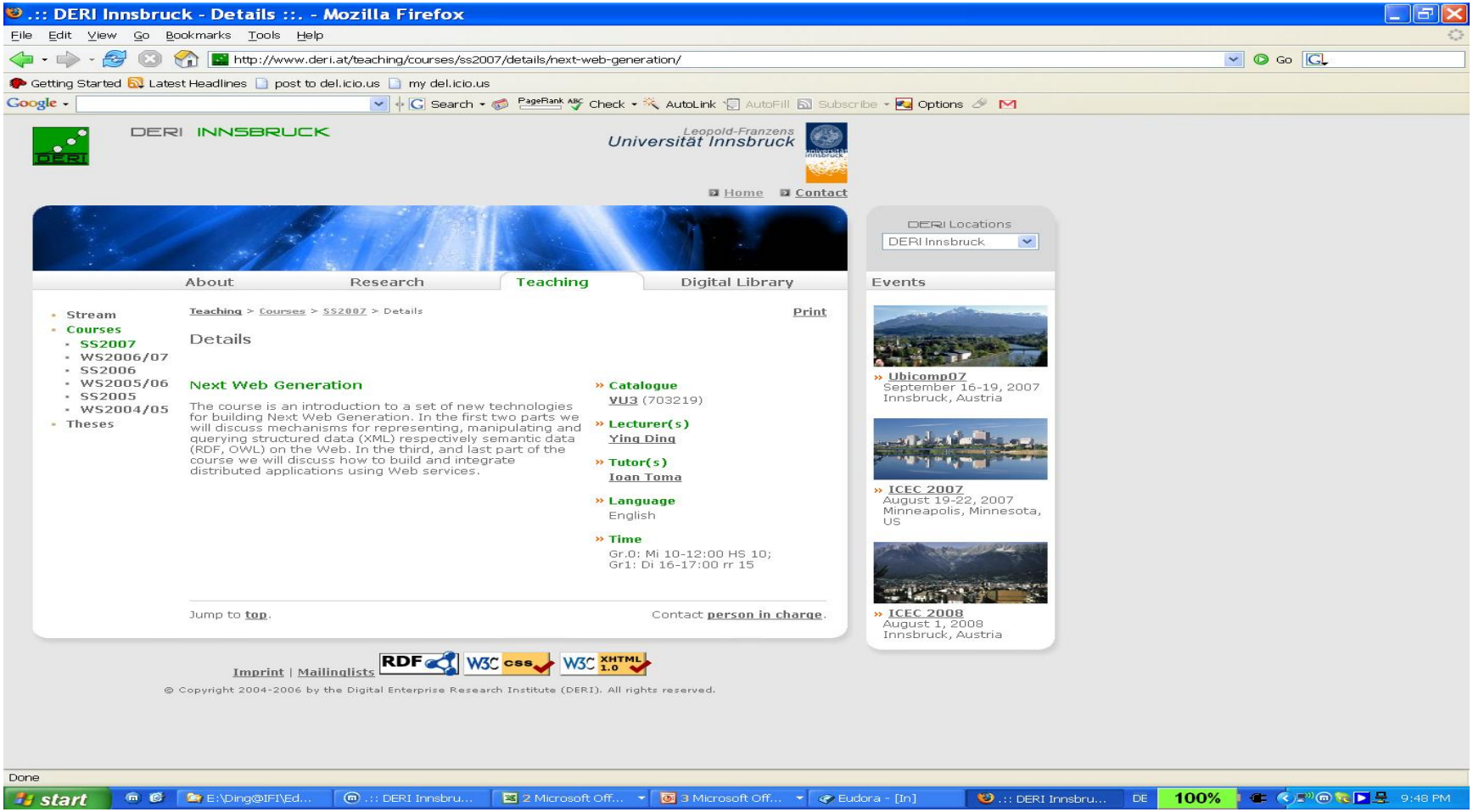
- Hypertext/hyperlink:
- Resource Identifiers
  - unique identifiers used to locate a particular resource (computer file, document or other resource) on the network
  - URI (Uniform Resource Identifier)/URL (Uniform Resource Locator): http or ftp
    - http://somehost/absolute/URI/with/absolute/path/to/resource.txt
    - 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

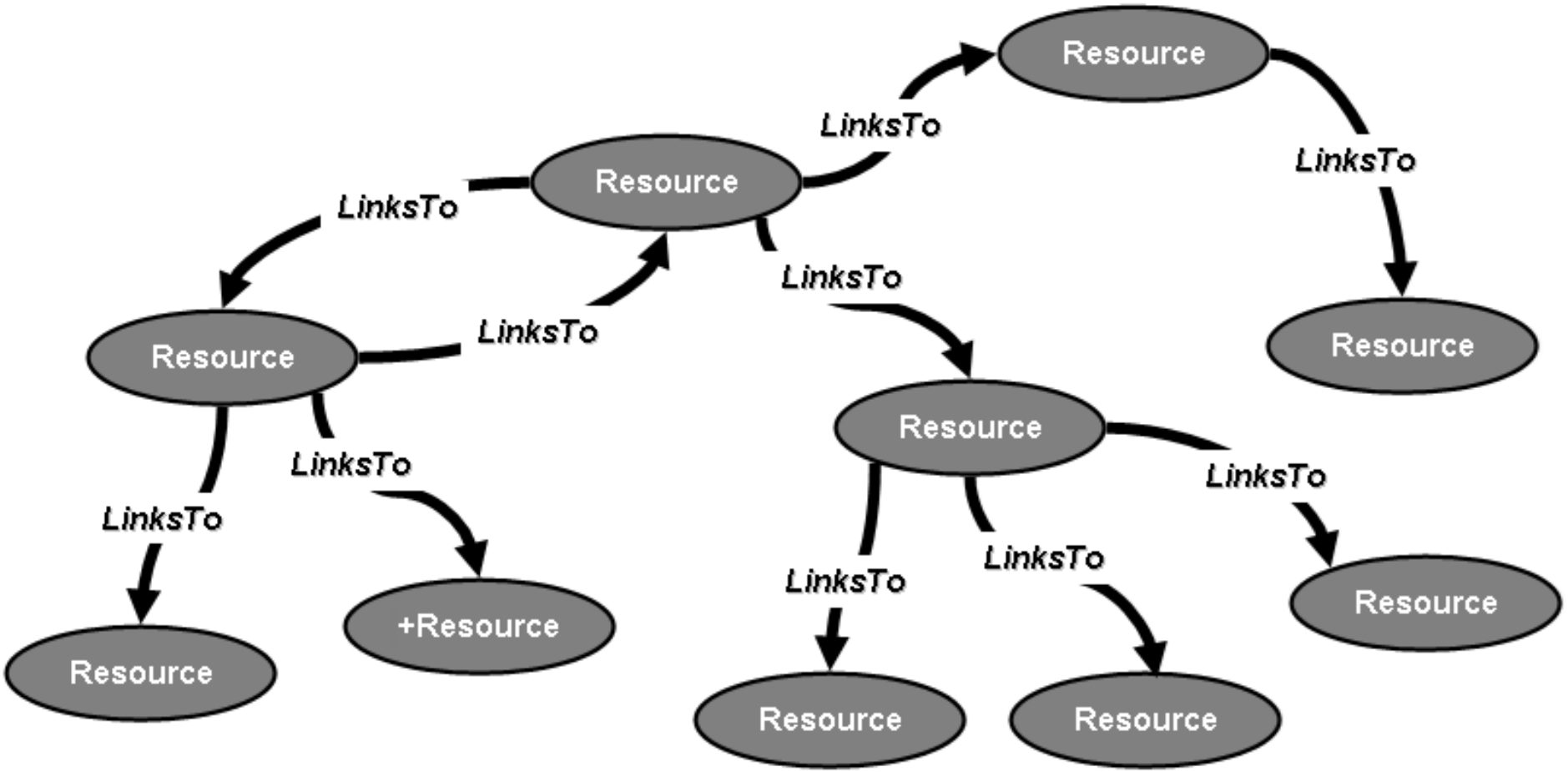


[Hendler & Miller 02]

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…

Features / principles of Web 2.0

1. The Web as platform
2. Harnessing collective intelligence
3. Data is the next “Intel Inside”
4. End of the software release cycle
5. Lightweight programming models
6. Software above the level of a single device
7. Rich user experiences

This fact leads to a key question:
Who owns the data

DSCF0831


Uploaded on July 23, 2005
by Cloudie

Cloudie's photostream


180 photos
View as slideshow
more browse more

This photo also belongs to:

2005_0721Yosemite (Set)


28 photos
View as slideshow
more browse more

yosemite (Pool)

Tags

yosemite

Additional Information

- Taken with a Fujifilm FinePix A210.
  More properties
- Taken on July 21, 2005
- Viewed **228** times

This photo is **public**

Comments


mtnjohn pro ys:

Great capture.
Posted 18 months ago. (permalink)


Cloudie pro ys:

Thanks!
Posted 18 months ago. (permalink)


Campin' Guy pro ys:

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

del.icio.us / url

popular | recent

your favorites | your network | subscriptions | links for you | post

logged in as **Cloudie** | settings | logout | help

» del.icio.us history for http://sioc-project.org/ check url del.icio.us search

sioc-project.org | Semantically-Interlinked Online Communities

http://sioc-project.org/

this url has been saved by 93 people.

SIOC Project edit / delete
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 imp
- 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 cloud | list

blog blogging blogs communities community deri design foaf metadata networks ontologies ontology owl project rdf research semantic semanticweb semweb sioc social socialnetworking socialsoftware toread web

related items - show ↓

posting history

» first posted by Wikier to sioc

Jan '07

by fhasi897 to ontology owl semanticweb
by agharbeia to metadata semanticweb sioc
by Kashirin_Victor to semantic
by glacial23 to socialsoftware
by fweez to web semantic social bullshit
by Cristie79 to semantic web

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

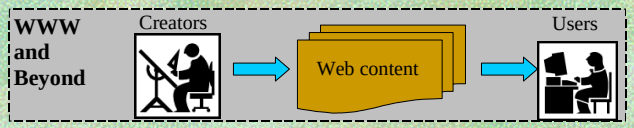
World Wide Web

Information on web is not suitable for software agents

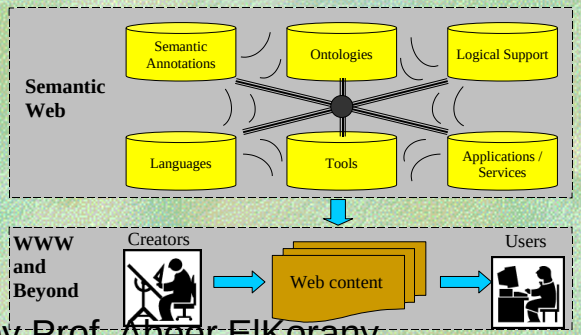
Semantic Web

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

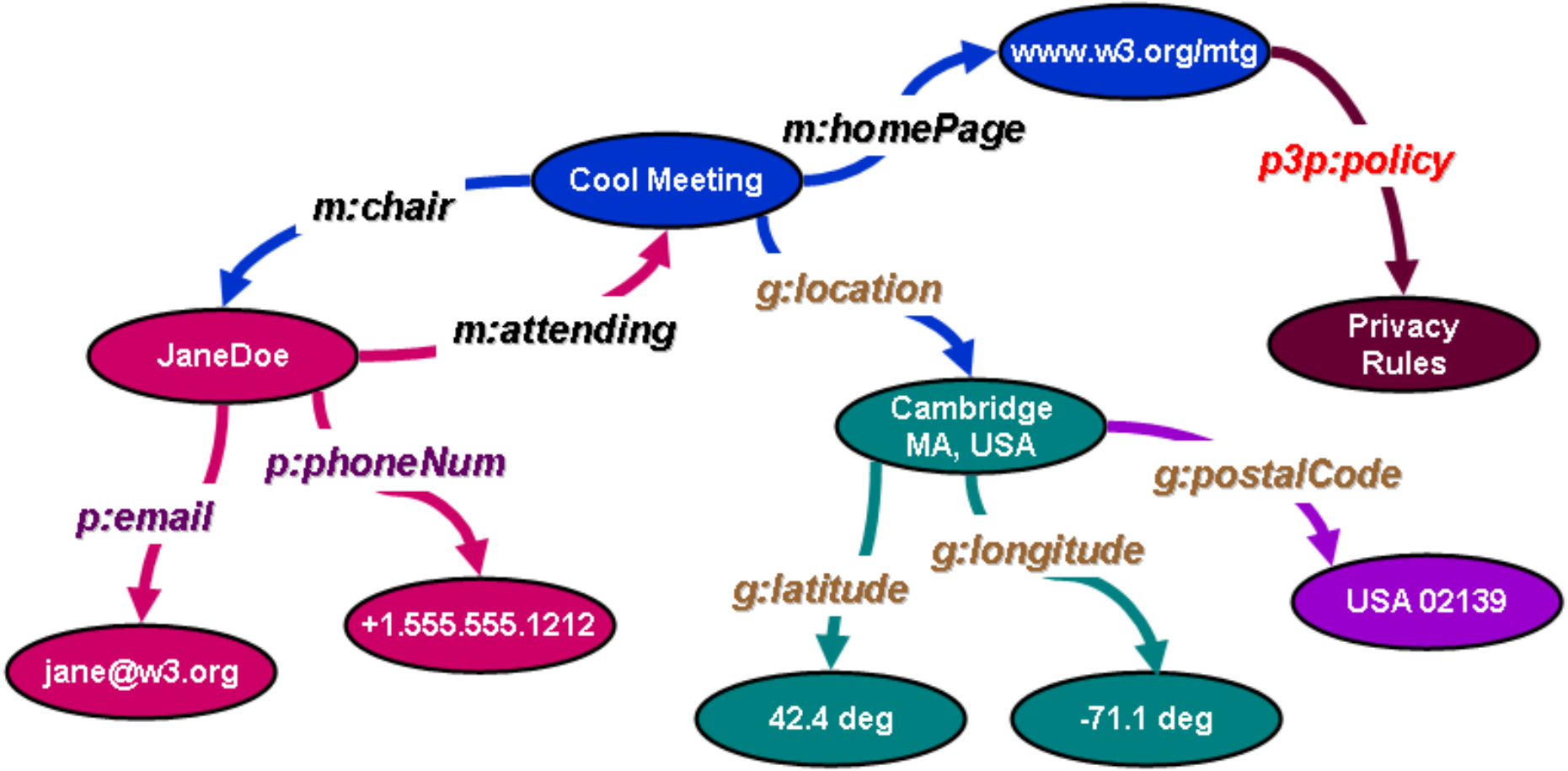
"The Semantic Web is a vision: the idea of having data on the Web defined and linked in a way that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications"

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

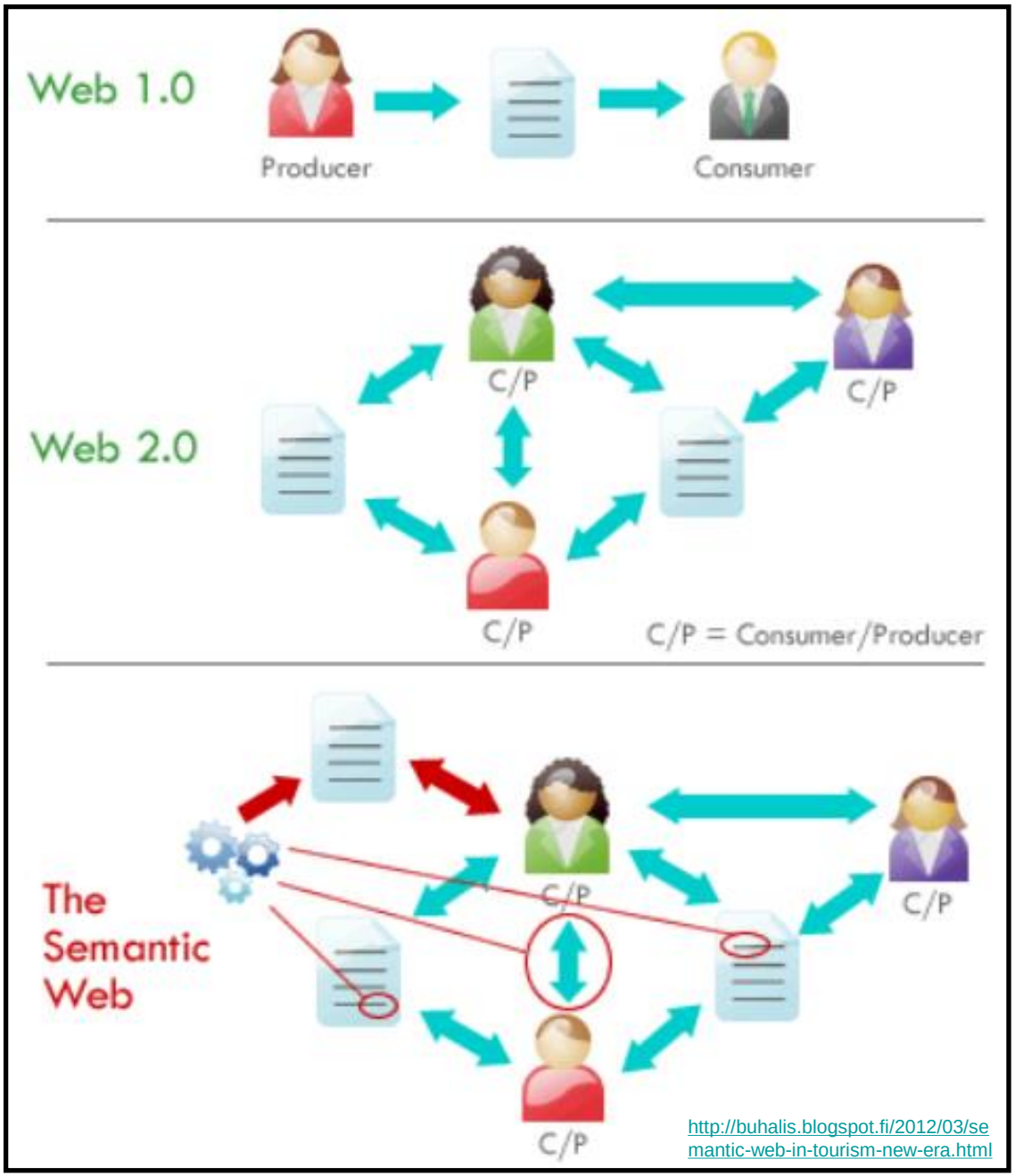
The Semantic Web is an initiative with the goal of extending the current Web and facilitating Web automation, universally accessible web resources, and the 'Web of Trust', providing a universally accessible platform that allows data to be shared and processed by automated tools as well as by people.

Semantic Web

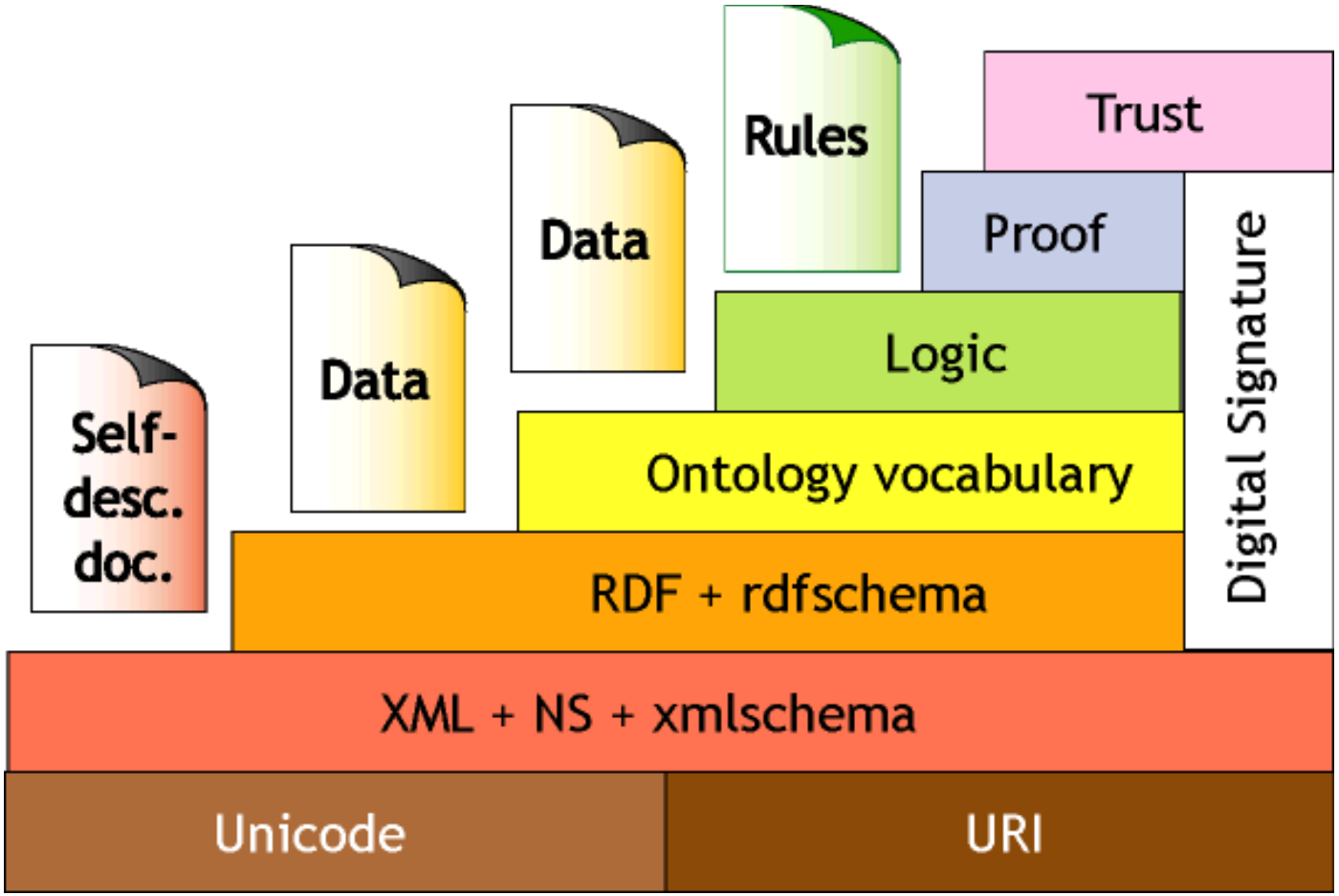
(data connected by relationships)



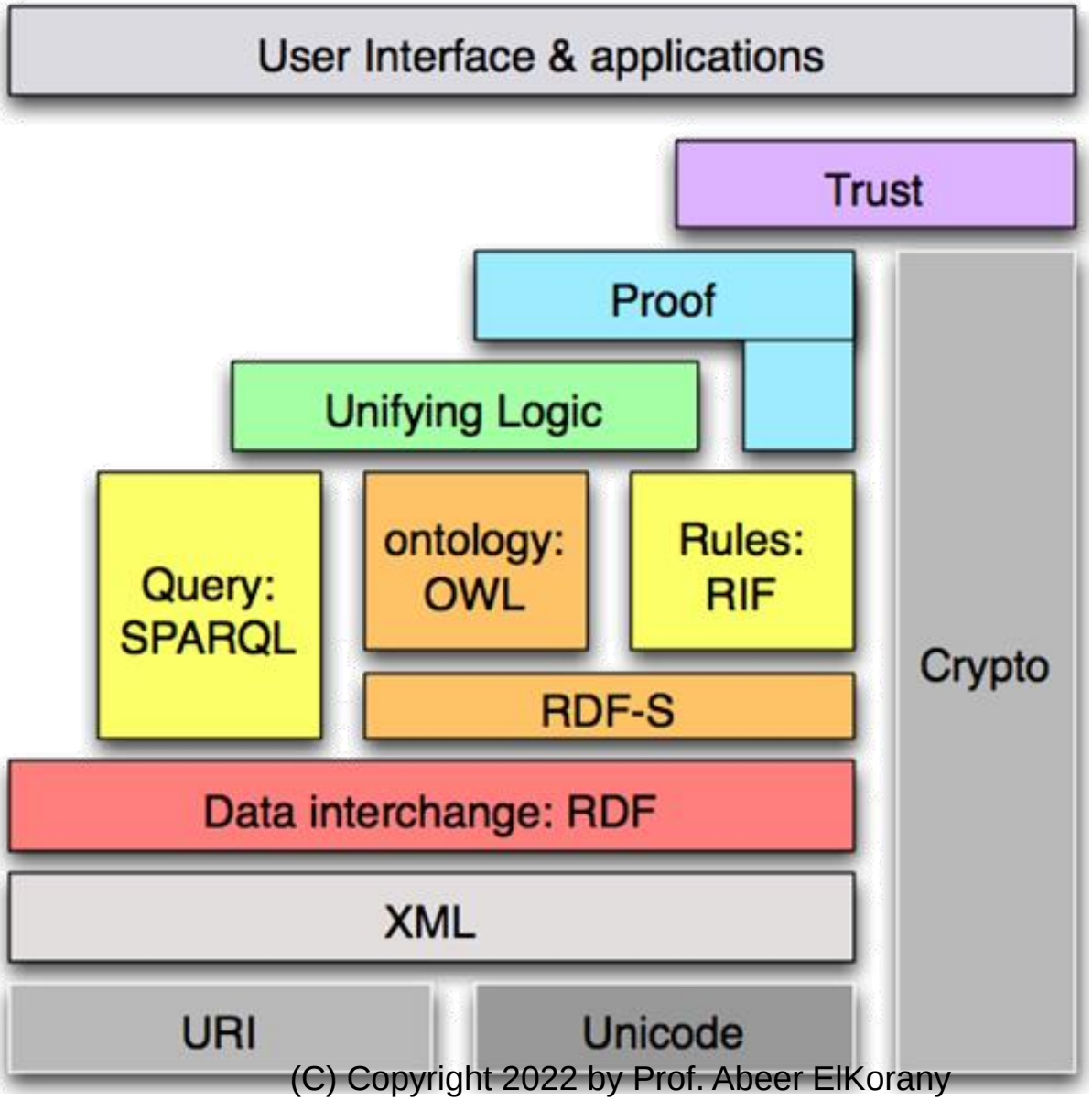
Semantic Web: Added Value



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



Semantic Web Stack
(updated, W3C, 2006)



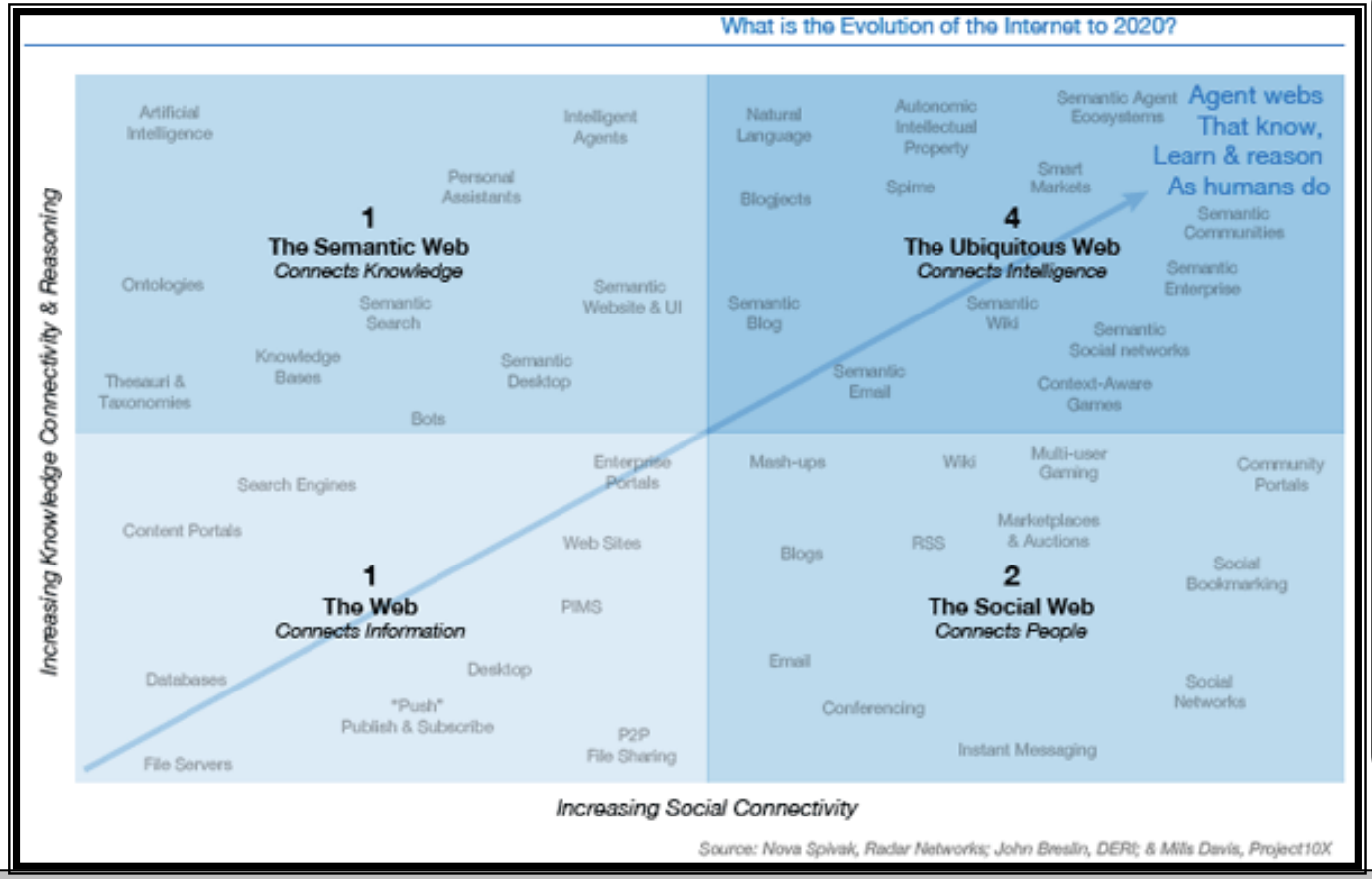
What is the Semantic Web?

- *"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)



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**]

Beyond Web 5.0 ?

Human v2.0 !

(?)

Brain-Machine Interfaces

https://www.youtube.com/watch?v=q-fE9QBy0FI

Brain-to-Brain Interfaces

https://www.youtube.com/watch?v=8ly9C5UOgIU

Nanobots

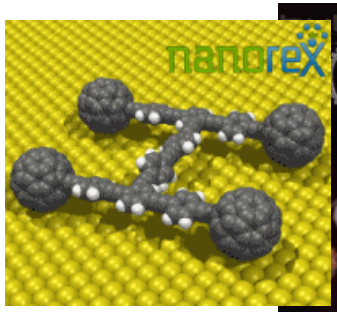
https://www.youtube.com/watch?v=UX_GdUCp3YM

2029

Singularity

Semantic Wave

Nanotech



https://www.youtube.com/watch?v=BNbK1e0wqEA

https://www.youtube.com/watch?v=fXB5-jwNah0

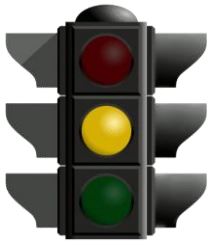
Agents are needed !

… 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

Semantic connector

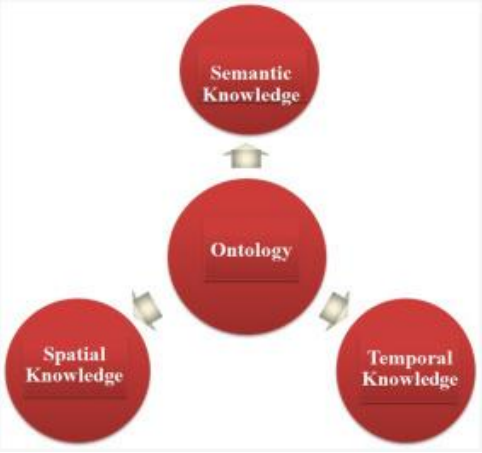
Semantic communication



Semantic SOA business logic

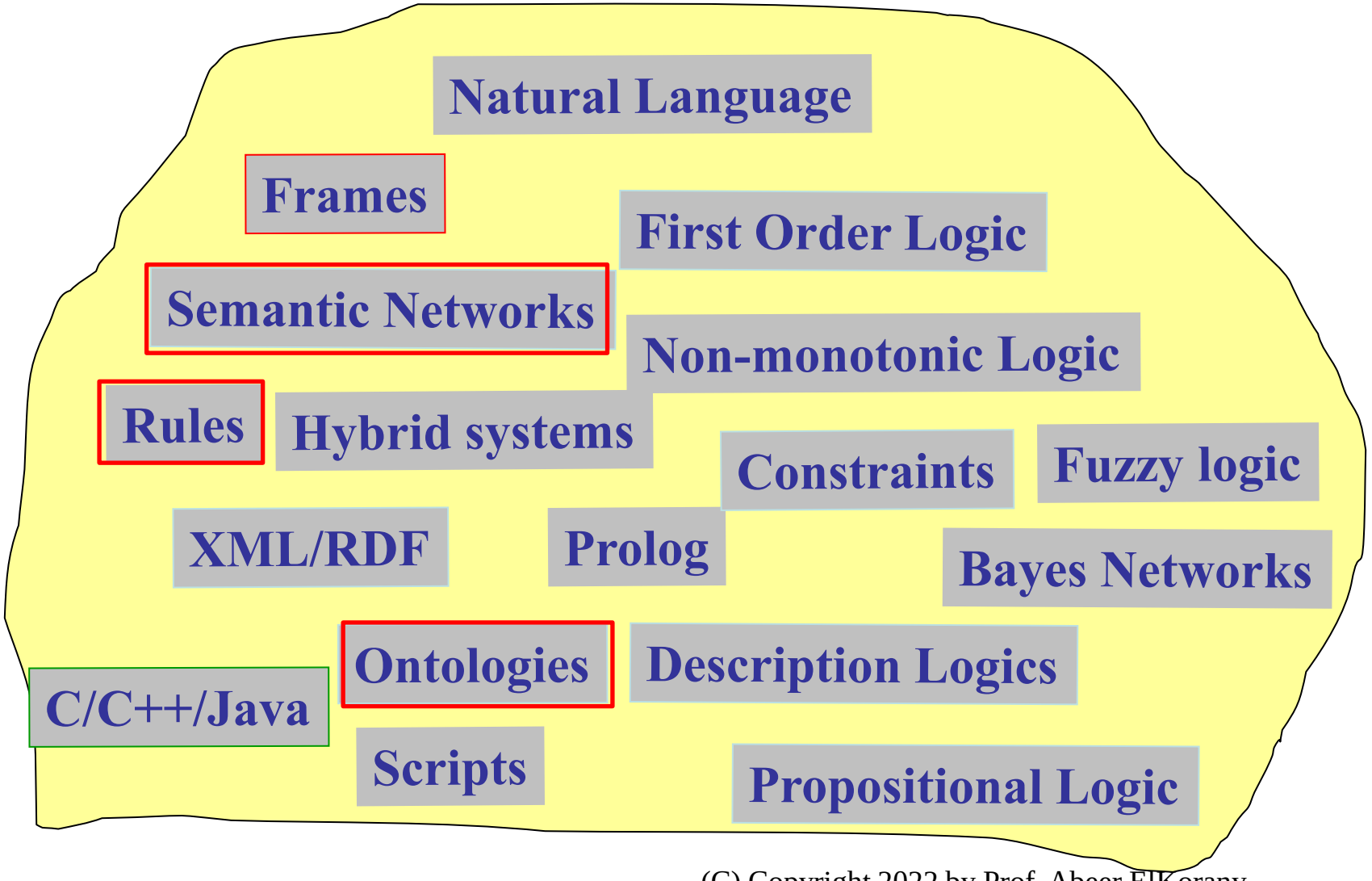
Ontology

- 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 conceptualizatio (e.g. by OO Models, or Entity Relationship model)
  - providing a ***shared and commo*** understanding of a domain that c 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