



# A 10-minute Introduction to Ontologies and the Semantic Web

**Oscar Corcho, Asunción Gómez-Pérez**

{ocorcho,asun}@fi.upm.es

<http://www.oeg-upm.net/>

Ontological Engineering Group  
Laboratorio de Inteligencia Artificial  
Facultad de Informática  
Universidad Politécnica de Madrid  
Campus de Montegancedo sn,  
28660 Boadilla del Monte, Madrid, Spain

# What is the Semantic Web



## THE SEMANTIC WEB

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

by  
TIM BERNERS-LEE,  
JAMES HENDLER and  
ORA LASSILA

- An extension of the current Web...
  - ... where information and services are given well-defined and explicitly represented meaning, ...
  - ... so that it can be shared and used by humans and machines, ...
  - ... better enabling them to work in cooperation
- How?
  - Promoting information exchange by tagging web content with machine processable descriptions of its meaning.
  - And technologies and infrastructure to do this

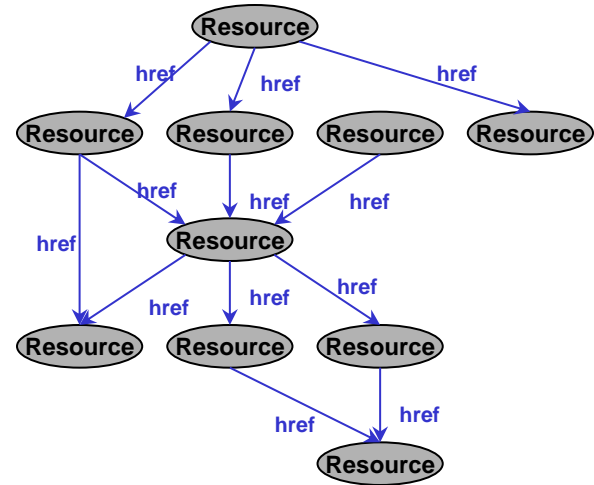
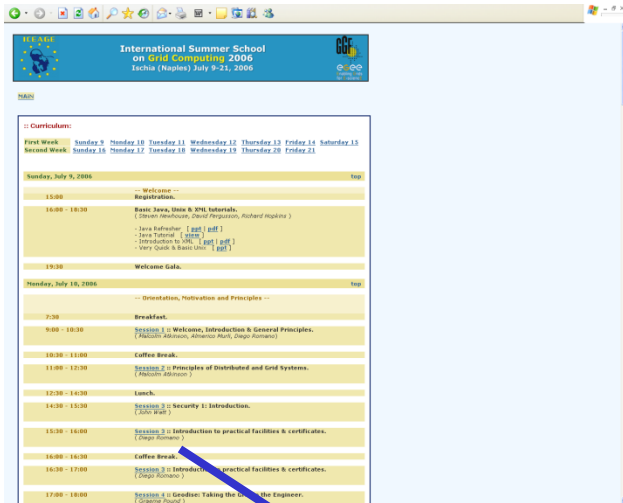
# The Semantic Web Vision

- **The Web was made possible through established standards**
  - **TCP/IP** for transporting bits down a wire
  - **HTTP & HTML** for transporting and rendering hyperlinked text
- **Applications able to exploit this common infrastructure**
  - Result is the WWW as we know it
- **Generations**
  - 1st generation web mostly handwritten HTML pages
  - 2nd generation (current) web often machine generated/active
    - Both intended for direct human processing/interaction
  - In the next generation web, resources should be more accessible to automated processes
    - To be achieved via semantic markup
    - Metadata annotations that describe content/function

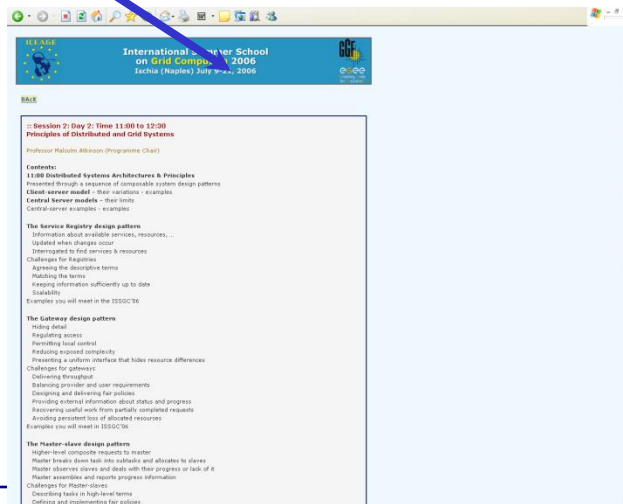
**The Syntactic Web**

**The Semantic Web**

# Where we are Today: the *Syntactic* Web

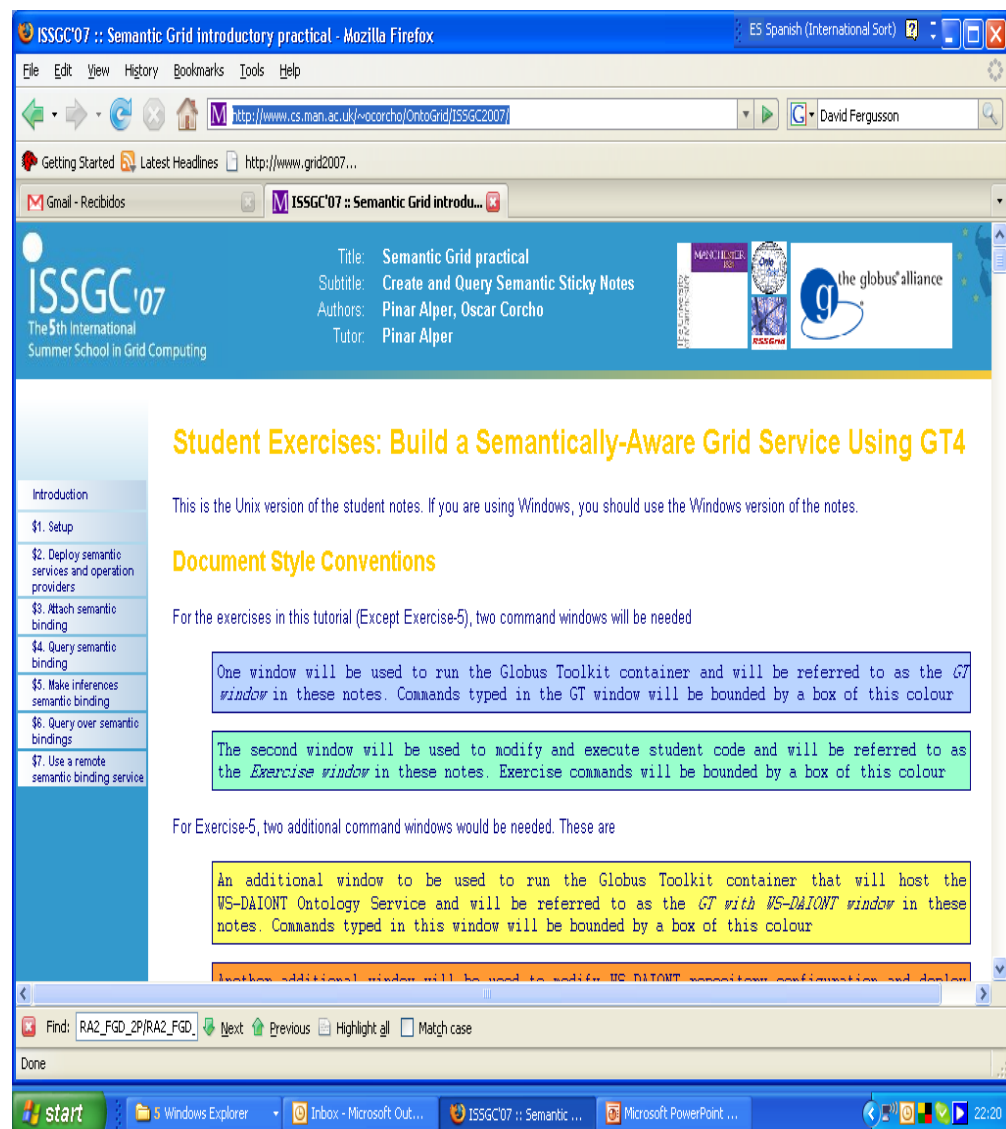


- A place where computers do the presentation (easy) and people do the linking and interpreting (hard).
- Why not get computers to do more of the hard work?



# What's the Problem?

- **Typical web page markup consists of:**
  - Rendering information (e.g., font size and colour)
  - Hyper-links to related content
- **Semantic content is accessible to humans but not (easily) to computers...**



# Information we can see...

**International Summer School on Grid Computing (ISSGC2007)**

**Semantic Grid practical**

**Pinar Alper, Oscar Corcho**

**Project logos... (sponsors/related projects/...?)**

**OntoGrid, RSSGRID, Globus**

**Student Exercises**

**Structured in seven chapters**

**Setup chapter**

**Instructions for each chapter**

**Code inside**

**Description of code**

**Material to change**

**Additional material**

...

## Information a machine can see...

[illegible]

## Solution: XML markup with “meaningful” tags?

<name></name>  
<date></date>  
<location></location>  
<introduction></introduction>  
<speaker></bio>  
</speaker>  
<speaker></bio>  
</speaker>  
<registration></registration>



# But What About...?

[illegible]

## Still the Machine only sees...

[illegible]

# Need to Add “Semantics”

- **External agreement on meaning of annotations**
  - E.g., *Dublin Core* for annotation of library/bibliographic information
    - Agree on the meaning of a set of annotation tags
  - Problems with this approach
    - Inflexible
    - Limited number of things can be expressed
- **Use Ontologies to specify meaning of annotations**
  - Ontologies provide a vocabulary of terms
  - New terms can be formed by combining existing ones
    - “Conceptual Lego”
  - Meaning (semantics) of such terms is formally specified
  - Can also specify relationships between terms in multiple ontologies

# Ontology in Computer Science

- **An ontology is an engineering artifact:**
  - It is constituted by a specific vocabulary used to describe a certain reality, plus
  - a set of explicit assumptions regarding the intended meaning of the vocabulary.
    - Almost always including concepts and their classification
    - Almost always including properties between concepts
    - ~~Similar to an object oriented model~~
- **Thus, an ontology describes a formal specification of a certain domain:**
  - Shared understanding of a domain of interest
  - Formal and machine manipulable model of a domain of interest

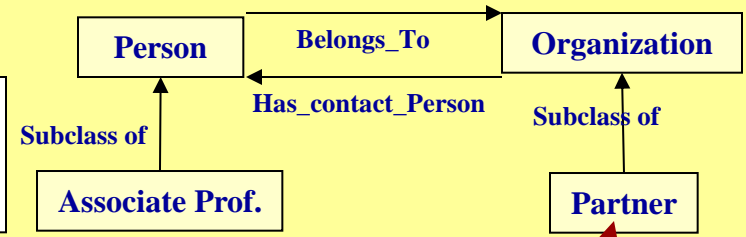
# Ontologies and Metadata



## Ontologies

```

xmlns:rdf='http://www.w3.org/1999/02/22-rdf-syntax-ns#'
xmlns:NS0='http://www.esperonto.net/semanticportal/RDFS/Person_Ontology#'
xmlns:NS1='http://www.esperonto.net/semanticportal/RDFS/Organization_Ontology#'
    
```



Instance of

Instance of

## Annotation (RDF)

```

<rdf:Description rdf:about='Asunción Gómez-Pérez'>
<rdf:type rdf:resource='Associate Prof'/>
<NS0:Full_Name>A. GomezPerez</NS0:Full_Name>
<NS0:Belongs_To>UPM</NS0:Belongs_To>
<NS0:e-mail>asun@fi.upm.es</NS0:e-mail>
    
```

Full Name	Asuncion Gomez-Perez
e-mail	asun@fi.upm.es
Photo	

Asunción Gómez-Pérez is contact person [UPM](#) ( Partner ).  
 Asunción Gómez-Pérez belongs to [UPM](#) ( Partner ).

```

<rdf:Description rdf:about='UPM'>
<rdf:type rdf:resource='Partner'/>
<NS1:Acronym>UPM</NS1:Acronym>
<NS1:Has_Contact_Person>Asunción Gómez-Pérez
</NS1:Has_Contact_Person>
    
```

Full Name	Universidad Politécnica de Madrid
Acronym	UPM
Logo	

UPM has contact person [Asunción Gómez-Pérez](#) ( Associate Professor ).  
 UPM participates in [Esperanto](#) ( Project ).  
 UPM team is formed by :

## Web Page

URL

<http://www.esperonto.net>

<http://www.esperonto.net>

# Course objectives and structure

- **Provide the theoretical and practical basis over the scientific, methodological and technological foundations of the Semantic Web**
  - To be used in the construction of applications that integrate, combine and derive information
  - Distributed and heterogeneous information
- **Structured**
  - Unit 1. Semantic Web introduction
  - Unit 2. Ontology development
    - RDF and RDF Schema
    - OWL
    - Ontology building methodologies
  - Unit 3. Semantic Web
    - Annotation
    - Semantic similarity
    - Semantic search

# Course outline

Content	Duration (hours)	Lecturer	Day
Introduction to the Semantic Web	3	Asunción Gómez-Pérez	19/5/2008
RDF and RDF Schema	4	Oscar Corcho Raúl García-Castro	8/5/2008
OWL	5	Oscar Corcho Mcarmen Suárez	13-14/5/2008
Ontology development methodologies	6	Asunción Gómez-Pérez Mcarmen Suárez	21-22/5/2008
Annotation	3	Oscar Corcho	10/6/2008
Semantic similarity	1,5	Asunción Gómez-Pérez	11/6/2008
Semantic search	1,5	Oscar Corcho	11/6/2008