

# **ECAI2004 tutorial summary**

## **Ontological Engineering**

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### ***Technical description***

Ontologies provide a common vocabulary of an area and define, with different levels of formality, the meaning of the terms and the relationships between them. Ontological Engineering refers to the set of activities that concern the ontology development process, the ontology life cycle, the methods and methodologies for building ontologies, and the tool suites and languages that support them. During the last decade, increasing attention has been focused on ontologies. Ontologies are now widely used in Knowledge Engineering, Artificial Intelligence and Computer Science; in applications related to areas such as Knowledge Management, Natural Language Processing, e-Commerce, Intelligent Information Integration, Bio-Informatics, Education; and in new emerging fields like the Semantic Web.

This tutorial will present the theoretical foundations of Ontological Engineering, will describe the most outstanding ontologies that are currently available, and will cover the practical aspects of selecting and applying methodologies, languages, and tools for building ontologies. This tutorial will also aim at presenting commercial-oriented and research-oriented ontology-based applications.

### ***Tutorial objectives***

This tutorial will give answers to the following questions:

- What is an ontology?
- Which design principles must be taken into account when building an ontology?
- Which types of ontologies do exist?
- How are ontologies organized in ontology libraries?
- Which is the difference between ontologies and knowledge bases?
- Which ontology building methods and methodologies do exist?
- Which tools can be used to develop ontologies?
- Which languages can be used to develop ontologies?
- Which is the relationship between ontology methods and methodologies, tools and languages?
- How has ontology technology been applied in different contexts?

After the four hours tutorial, participants will be familiar with the theoretical foundations of this field, will be able to build ontologies and identify potential applications for this technology.

## **Tutorial content**

The contents of the tutorial are mainly based on the contents of the book “Ontological Engineering”<sup>1</sup> that has been recently published (November 2003) by Springer-Verlag, and which has been authored by the three tutorial presenters. We will also reserve a time slot for presenting ontology-based applications.

***Theoretical foundations of ontologies (30 minutes)***. We will comment on the problems that appear when building knowledge-based systems from scratch and when reusing and sharing knowledge in knowledge-based systems. We will talk about the Knowledge Sharing initiative. We will explain several ontology definitions, we will define what ontological commitments are and will present the main components that usually appear in an ontology. We will focus later on the different types of ontologies that can be found, and the place where to find them: ontology libraries. We will end this session with a description of ontology design criteria and a summary of the differences between ontologies and knowledge bases.

***The most outstanding ontologies (30 minutes)***. We will describe the most relevant ontologies that have been created till now: knowledge representation ontologies, top level ontologies, linguistic ontologies and domain ontologies (engineering ontologies, knowledge management ontologies, medical ontologies, enterprise ontologies, chemistry ontologies, etc.).

***Methods and methodologies to build ontologies (45 minutes)***. We will describe methods and methodologies for ontology building, ontology reengineering, cooperative construction, ontology learning, ontology merge, etc.

***Ontology languages (45 minutes)***. We will describe the languages that can be used to implement ontologies, from classical languages (Ontolingua, LOOM, OCML, FLogic, etc.) to ontology markup languages (SHOE, XOL, RDF, RDF Schema, OIL, DAML+OIL, OWL, etc.). We will see which components can be handled in each of them, how their inference engines work, etc.

***Ontology development tools (45 minutes)***. We will describe different kinds of tools and integrated platforms that can be used for ontology construction (the Ontolingua Server, OntoEdit, OIEd, Protégé-2000, WebODE, WebOnto, etc.). We will also describe tools for merging ontologies (PROMPT, Chimaera), tools for evaluating ontologies (ONE-T, ODEClean), etc.

***Ontology-based applications (45 minutes)***. We will describe successful applications of ontology technology in many different areas, such as knowledge management, e-commerce, Semantic Web, natural language processing, intelligent integration of information, etc.

## **Target audience and their background**

This tutorial is aimed at researchers from various communities:

- Ontologies

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<sup>1</sup> <http://webode.dia.fi.upm.es/ontologicalengineering/>

- Semantic Web
- Knowledge engineering
- Knowledge acquisition, sharing and reuse

Our recommendation is that participants should have some background on knowledge representation formalisms (frames, semantic networks, logic, etc.) and Artificial Intelligence.

## **Presenters**

As commented above, the tutorial will be presented by the three authors of the book “Ontological Engineering”, recently published by Springer-Verlag. The presenters are: Asunción Gómez-Pérez, Mariano Fernández-López and Oscar Corcho.

Besides being co-organizers of the First European Summer School on Ontological Engineering and the Semantic Web (ESSSW2003), held in Cercedilla (Spain) in July 2003, the presenters have taught the following tutorials:

- Ontology Engineering and the Semantic Web. **ATHENS course**. March 2003.
- Ontologies: Methodologies, tools, languages and applications. **IBERAMIA2002 tutorial**. November 2002.

Moreover, Asunción Gómez-Pérez has taught the following tutorials:

- Knowledge Representation and Ontologies. **ESSSW2003**. July 2003.
- Ontologies and the Semantic Web. **Agentlink summer school**. July 2002.
- Ontological Engineering. **IJCAI99 tutorial**. August 1999.
- Ontological Engineering. **ECAI98 tutorial**. August 1998.
- Knowledge Sharing. **SEKE97 tutorial**. June 1997.

They have also been invited to give more than 10 invited talks and seminars about Ontological Engineering in different universities and conferences, and they have been teaching for 7 years the PhD course “Ontological Engineering” at the Artificial Intelligence Department of the Computer Science School at UPM.

Their contact details and brief resume are included below:

<p><b>Dr. Asunción Gómez-Pérez</b>            Facultad de Informática            Universidad Politécnica de Madrid            28660 Boadilla del Monte            Madrid</p>	<p><b>Dr. Mariano Fernández-López</b>            Facultad de Informática            Universidad Politécnica de Madrid            28660 Boadilla del Monte            Madrid</p>	<p><b>MSc. Oscar Corcho</b>            Facultad de Informática            Universidad Politécnica de Madrid            28660 Boadilla del Monte            Madrid</p>
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**Dr Asunción Gómez-Pérez** is the Director of the Ontology Group at UPM. She is BA in Computer Science (1990), MSc in Knowledge Engineering (1991), and PhD in Computer Science (1993) by Universidad Politécnica de Madrid (UPM). She is also MBA (1994) by Universidad Pontificia de Comillas. She was visiting (1994-1995) the Knowledge Systems Laboratory at Stanford University. She is Associate Professor at the Computer Science School at UPM. She was the Executive Director (1995-1998) of the Artificial Intelligence Laboratory at the school and she is currently a research advisor of the same lab. She is the director of the Ontology Group at the lab since 1995.

Her current research activities include, among others: Interoperability between different kinds of ontology development tools, Methodologies and tools for building and merging ontologies, Ontological Reengineering, Ontology Evaluation and Ontology Evolution, as well as Uses of ontologies in applications related with Semantic Web, e-commerce and Knowledge Management. The most representative projects where she is participating are: the OntoWeb thematic network (IST-2000-25056), Esperonto Services (IST-2001-34373), and PIKON (IST-2001-33487). She acts as consultant of the European Commission on the FP6 program on the topic of Knowledge Technologies. She has published more than 70 papers on the above issues. She has led several national and international projects related to ontologies funded by various institutions and/or companies. She is author of one book on Ontological Engineering and co-author of a book on Knowledge Engineering. She was the chair of the 13<sup>th</sup> International Conference on Knowledge Acquisition and Management (EKAW-02). She has been co-organizer of the workshops and conferences on ontologies at IJCAI-01, ECAI-00, IJCAI-99, ECAI-98, SSS-97 and ECAI-96. She has taught tutorials on Ontological Engineering at ECAI-98, SEKE-97 and CAEPIA-97. She acts as reviewer in many conferences and journals.

**Dr Mariano Fernández-López** is BA in Computer Science (1996), MSc in Knowledge Engineering (2000), MSc in Software Engineering (2000), and PhD in Computer Science (2001) by Universidad Politécnica de Madrid (UPM). He won the first Extraordinary Award of Doctoral Thesis at the Computer Science School at UPM (2002). He is Associate Professor at the Technical School of Fundación Universitaria San Pablo CEU.

His research activities include ontology development and merging methodologies, and ontology tools. He visited the E-Commerce Group at the University of Sunderland (2001 and 2003), the Ontology Group at the LADSEB-CNR (Padua, Italy) (2001), and the Computer Science Department at the Liverpool University (2002). He is author of one book on Ontological Engineering, and has published over 20 journal and conference papers on ontology methodologies and tools. He is reviewer in some conferences and workshops, was member of the programme committee of EKAW'02, and of the First and the Second Latin American Conference on Software Engineering and Knowledge Engineering, and was the tutorial and workshop chair at EKAW'02.

MSc **Oscar Corcho** belongs to the Ontological Engineering Group of the Computer Science School at the Technical University of Madrid (UPM). He graduated in Computer Science from UPM in 2000, and received the third Spanish award in computer science from the Spanish Government. He obtained his MSc in Software Engineering from UPM in 2001, and he will obtain his PhD in Artificial Intelligence in Spring 2004.

His research activities include ontology languages, ontology development tools, the ontology translation problem and the Semantic Web. He is participating at the Knowledge Web network of excellence, at the OntoWeb thematic network (IST-2000-25056) and at the IST Esperonto project (IST-2001-34373). He has been a research visitor at KMI (Open University) and SMI (Stanford University). He has published the book "Ontological Engineering". He has also published over 20 journal and conference papers on ontology languages, tools and applications in important forums for the ontology community (ISWC, EKAW, KAW, KCAP, AI Magazine, IEEE Intelligent Systems) and has reviewed papers in several conferences, workshops and journals. He chaired the demo sessions at EKAW2002 and co-organized the ISWC workshop on Evaluation of Ontology Tools (EON2003).