E-D5

REWERSE graduate courses: a preliminary list

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Abstract

This document presents a structure of the field of the Semantic Web emerging from the information on Semantic Web-relevant courses collected in the REWERSE deliverable E-D1 and a list of introductory courses addressing a majority of topics identified in this structure. A brief description of each of the courses is given and the names of the REWERSE members who committed themselves to develop learning materials for inclusion into the VISWE repository (called VISWER). The materials are to be used at the 2005 REWERSE Summer School.

Keyword List
education and training, semantic web

REWERSE graduate courses: a preliminary list

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28 February 2005

Abstract
This document presents a structure of the field of the Semantic Web emerging from the information on Semantic Web-relevant courses collected in the REWERSE deliverable E-D1 and a list of introductory courses addressing a majority of topics identified in this structure. A brief description of each of the courses is given and the names of the REWERSE members who committed themselves to develop learning materials for inclusion into the VISWE repository (called VISWER). The materials are to be used at the 2005 REWERSE Summer School.

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Contents

1 Introduction

This deliverable documents a step towards the development of a curriculum of graduate courses for education of researchers and practitioners in the field of Semantic Web, to be supported by the course material published on the Web. A starting point of this work was an effort to collect the information about Semantic Web related courses offered worldwide. The collected course descriptions were summarized in the REWERSE Deliverable E-D1.

According to the agreement between REWERSE and the Knowledge Web FP6 Network of Excellence (REWERSE Deliverable E-D2), the Web-based infrastructure for the Semantic Web education is developed jointly by Knowledge Web and REWERSE (its design is discussed in the REWERSE Deliverable E/T-D4). The existing version of the infrastructure is a repository of educational materials (VISWER), maintained by the REWERSE partner Hannover in cooperation with Knowledge Web's Virtual Institute of Semantic Web Education (VISWE).

This document presents a preliminary list of graduate courses whose electronic educational materials are to be developed by REWERSE and published in VISWER. These courses are included in the programme of the First REWERSE Summer School, "Reasoning Web", to be held at Malta July 25-29, 2005 (Deliverable E-D3). The ongoing curriculum work is expected to outline a structure of the field of the Semantic Web (a Semantic Web ontology) and to develop a respective structure of educational modules, supported by electronic materials. Analysis of the course information collected in E-D1 shows the main components of this structure. This provides a basis for choosing first REWERSE courses to be published in VISWER, and for planning the REWERSE Summer School 2005. A guideline for making the selection was to spread the courses over different components of the emerging structure and to focus on the topics covered by REWERSE competence and directly related to REWERSE research.

The document is organized as follows. Section 2 describes the proposed strategy for developing a Semantic Web curriculum. Section 3 discusses the structure of the field emerging from the information in the deliverable E-D1 on existing Semantic Web courses. Section 4 presents the list of the selected courses with brief descriptions. Section 5 provides a summary and conclusions concerning the continuation of the curriculum work.

2 The proposed strategy of curriculum work

The graduate curriculum should describe a proposed structure and options of Semantic Web graduate education. It should be supported by Web learning materials accessible in VISWER. Identification of the structure of the field and development of the e-learning materials are complementary inter-related tasks. This section outlines a strategy for addressing them with the objective of defining the curriculum.

2.1 Target groups and their needs

The graduate curriculum will have two main groups of users. We analyse briefly their needs.

- **Teachers** The curriculum should provide the university teachers interested in the area of Semantic Web with a clear view of the area. It should present the structure of the field so that it is easy for a new teacher to identify the foundations, existing technologies, relations to other fields and main research directions. It should reflect the current state of the art. The courses suggested by the curriculum should be supported by ready-to-use

educational materials, prepared by experts, and complemented by a license protecting the intellectual property rights (provided in VISWER). From the new teachers point of view, it is important that the courses have solid material: slides, developed lecture notes, references to articles etc. It is very good if the electronic material refers to existing textbooks, which start to emerge. It is desirable that the learning units are of limited size so that larger courses can be built from smaller units in a modular way.

- **Students** The curriculum will be addressed to students who want to work and learn the Semantic Web topics on their own. Thus, again it should give a clear well-structured view of the field where interesting topics can be found easily.

  It is important to distinguish between the advancement levels. As the area is new, general introductory materials are needed for people not familiar with the field. Master students need a good introduction to the foundations on which the technologies are built. PhD students specializing in the field need advanced courses.

As Semantic Web technologies are not widely used in practice, both groups of potential users of the curriculum need a good motivation. It is, thus, very important that the courses provide good examples showing the need for new solutions. As Semantic Web is a new area of research, which is developing rapidly, it is important that the learning materials present the state of the art. This may often require updates.

2.2   Stepwise development of the curriculum

The curriculum work includes definition of the structure of the field and development of learning units addressing elements of the structure. The discussion on the structure of the field was initiated by analysis of the already offered university courses relevant for the Semantic Web (deliverable E-D1). However, this is a time consuming process subject of the ongoing discussion. A preliminary rough proposal resulting from this work is discussed in the next section. The structure presented therein definitely needs refinement, and perhaps also partial re-structuring. On the other hand, we hope that it already identifies certain topics which will definitely be included also in the later versions.

We propose to use it as a starting point for development of first REWERSE courses supported by the e-learning material to be placed in VISWER. These first courses should cover different aspects of the emerging structure and thus provide a general introduction to various aspects of the Semantic Web. The relations between them will partly be indicated by associating them with the nodes of the emerging structure. The choice of the courses based on the above stated criteria is discussed in Section 4. The courses will be included in the programme of the REWERSE Summer School 2005 (Deliverable E-D3).

The continued curriculum work aims at refining the structure presented in this document and at supporting the refined structure by further learning material to be included in VISWER in forthcoming years. Thus, we suggest the curriculum and the supporting learning materials are to be developed in a stepwise manner where the work on defining the structure is interleaved with the work of developing learning materials for the emerging elements of the structure.

3 Towards a Semantic Web Ontology

This Section outlines a preliminary structure emerging from the analysis of the descriptions of the Semantic Web related courses collected in deliverable E-D1[1].

3.1 Courses described in E-D1

The deliverable E-D1 provides a survey on already offered and planned courses on Semantic Web worldwide. The information about courses was obtained from several independent sources:

- from REWERSE participants in response to a REWERSE Web questionnaire,

- from Knowledge Web participants

- from an independent effort at the University of Heraklion

- from Frank van Harmelen, who provided information about a number of courses offered outside of REWERSE and Knowledge Web.

We believe that the list of courses reflects to some extent the worldwide state of the Semantic Web education in Spring 2005. We use it as a starting point for further analysis. In the Appendix, we attach the complete list of courses collected in E-D1. To get descriptions of these courses see the deliverable E-D1.

Deliverable E-D1 provides descriptions of 64 courses. 59 of them are full-term master courses and 5 are short courses with less then 10 teaching hours. 25 courses originate from REWERSE, 20 from KnowledgeWeb, one was included both in REWERSE and in the KnowledgeWeb information, 9 come from the Heraklion collection, 8 from van Harmelen's collection and 1 from Budapest.

3.2 Semantic Web: Core Areas

The analysis of the Semantic Web relevant courses of the deliverable E-D1 identifies some core areas providing foundations for development of Semantic Web specific technologies. This section presents a first attempt to structure these areas and topics with the objective to develop a graduate curriculum for Semantic Web education. This can also be seen as a step towards defining an ontology of the Semantic Web. The draft proposal for such a structure is presented below as a list of areas, in most cases with indicated subareas and topics. We consider the list as a starting point for discussion on the structure of the field of the Semantic Web. This may lead to a modification of the structure, and to an inclusion of new topics. However, we believe that the core topics of the list will also be included in the modified structure. Courses addressing these topics should be developed in the first hand, or adapted from existing bodies of courses described in E-D1, and should be supported by learning materials in VISWER.

The Semantic Web builds upon and extends the existing body of knowledge addressed in Computer Science curricula. To indicate this relationship, the proposed structure uses, whenever possible, the terminology and classification of the IEEE/ACM Computer Science Curriculum CC2001[2]. Some of the topics on the list may later be classified as prerequisites. Formulation of prerequisites is an important topic in the next stage of curriculum work. At the

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[1]see http://ida.liu.se/~artwi/Rewerse/ET/internal/E-D1.pdf
[2]http://www.computer.org/education/cc2001/

moment we assume that the student have necessary background in computer programming so that the list does not include the topics in this area.

IS Intelligent Systems

  IS1 Knowledge Representation and Reasoning

      Logics
          Predicate Logic
          Description Logics
          Horn Logic
          F-logic
          Modal Logics
      Basics of automated reasoning
      Logic Programming and Non-monotonic Reasoning
      Reasoning on Action and Change
      Temporal and Spatial Reasoning

  IS2 Agents

  IS3 Natural Language Processing

IM Information Management

  IM1 Data Modeling
      Conceptual models; ontologies, UML
      Relational data model
      Semistructured data
      Object-oriented model

  IM2 Database systems
      Relational databases
      Object-oriented databases
      Distributed databases

  IM3 Hypertext and Hypermedia

WT Basic Web information technologies

  WT1 XML
      Namespaces
      Schema languages
      XML query and transformation languages
      XML programming techniques

  WT2 Web data integration

  WT3 Security

  WT4 Web services

  WT5 Personalization techniques

SW Semantic Web

> SW1 Basic ideas of the Semantic Web
>
> SW2 Resource Description Framework
>
>> RDF basics
>> RDF Schema
>> RDF Query Languages
>
> SW3 Ontologies
>
>> Web Ontology languages
>> Ontology Engineering
>
> SW4 Rules on the Semantic Web
>
> SW5 Semantic Web Applications
>
>> Web Services
>> e-Learning
>> Bioinformatics
>> Other

It should be noticed that the web/semantic web-specific areas (WT and SW) in the above structure build upon the concepts and technologies of IS and IM areas to a large extent. For example, one can mention connections between semistructured data models and XML, between Description Logics and Web Ontology Languages, or between Logic Programming and emerging Web Rule Languages. These relations should be subject of further analysis within REWERSE ET activities.

4 Developing courses for the curriculum

We will use the structure, outlined in the previous section, and its future modifications to define the REWERSE courses whose material is to be published in VISWER.

This section presents a list of the first REWERSE courses to be developed for inclusion in VISWER. The choice of these courses is motivated by the objective to provide a broad introduction to Semantic Web with focus on web reasoning. There is a growing interest concerning the ideas of the Semantic Web, while the user community is still rather small. Therefore, development and publication of good introductory material is of great importance. The courses on our list should give a broad coverage of the topics listed in the previous section.

As the objective of 2005 REWERSE Summer School is also an introduction to the Semantic Web and web reasoning, the selection of the courses was co-ordinated with the effort of planning the School. Thus, the participants of the School will be among the first users of the developed learning materials. The 2005 Summer School programme extends the list of courses presented below with some additional tutorials (Full description of the Summer School programme and the materials will be included in the deliverable E-D3). The brief descriptions of the courses given below are classified by core areas of the structure discussed in the previous section. The descriptions include the names of the people who committed themselves to prepare the respective courses/tutorials for the Summer School. The first course of the list gives an introduction to the relatively well-established concepts of the Semantic Web. The following 6 courses on the

list are offered, respectively by the REWERSE Working Groups WG I1-I5, and by WG A3. The remaining 2 courses are short tutorials.

1. Fundamentals of Semantic Web Ontology Languages
   Author: G. Antoniou, E. Franconi and F. van Harmelen
   Lecture hours: 6
   Classification: IS1, SW1, SW2, SW3

   In the context of the Web, an ontology is a formal description of a domain of discourse, providing a conceptualization to be shared by application developers and users.

   This course is a tutorial on Semantic Web ontology languages, designed to provide such formal descriptions. The focus is on the languages RDF Schema and (different variants of) OWL, adopted as standards by the W3C. An introduction to the languages illustrated by examples, will clarify importance of ontology engineering. The course will also explain the logical foundations of OWL by providing an introduction to the underlying Description Logic and its use in ontology reasoning on the web.

2. Rule Modeling and Markup
   Author: G. Wagner
   Lecture hours: 4
   Classification: IM1, SW2, SW3

   UML provides an abstract syntax (in the form of a MOF metamodel) and a concrete visual syntax for defining vocabularies in the form of "class models". It also comes with an abstract and concrete syntax, called the Object Constraint Language (OCL), for expressing logical sentences in the signature defined by a class model. The combination of UML class diagrams and OCL will be presented as a basic framework for modeling vocabularies and rules.

   Very recently, in an effort to extend its UML modeling framework, the OMG has adopted a new approach to modeling business vocabularies and rules in the form of controlled English sentences, as this is regarded to be the most user-friendly formalism for specifying vocabularies and rules.

   The course will present these OMG modeling languages and relate them to the W3C knowledge representation languages RDF and OWL and to their extensions N3 and SWRL. The abstract syntax will be presented in the form of MOF metamodels.

3. Attempto Controlled English
   Author: N. E. Fuchs
   Lecture hours: 4
   Classification: IS3, SW1

   Knowledge can be represented in natural or in formal languages. While natural languages are easy to use and need not be learned, they are also prone to ambiguity and vagueness. Formal languages on the other hand have a well-defined syntax and unambiguous semantics, but are considered by many people as incomprehensible. The EU Network of Excellence REWERSE has realized the great potential of controlled languages to render notations both human-readable and computer-processable. REWERSE will, for instance, use controlled English to express, to reason about, and to execute business and policy rules. REWERSE Working Group I2 in co-operation with REWERSE Working Group

I1 is currently designing REWERSE's controlled English on the basis of Attempto Controlled English that was developed at the University of Zurich. ACE is a specification and knowledge representation language – is a controlled subset of standard English that allows users to express technical texts precisely, and in the terms of their respective application domain. ACE texts are computer-processable and can be unambiguously translated into first-order logic. ACE appears perfectly natural, but – being a controlled subset of English – is in fact a formal language with the semantics of the underlying first-order logic representation. Attempto Controlled English, and the Attempto system in general, are intended for domain specialists who want to use formal notations and formal methods, but may not be familiar with them. Thus the Attempto system has been designed in a way that allows users to work solely on the level of ACE without having to take recourse to its internal logic representation.

4. Reuse in Semantic Web Applications
   Author: U. Assmann
   Lecture hours: 2
   Classification: SW3, SW4, SW5

   As with other artefacts of software and systems engineering, applications on the future semantic web need an appropriate reuse technology. The tutorial explains two general forms of reuse mechanisms: refinement-based reuse of models and compositional reuse of components. It discusses then how these reuse mechanisms can ensure flexible construction of semantic web applications, because they support variability, extensibility and interoperability.

5. Web and Semantic Web Query Languages: Standards, State of the Art, and Perspectives
   Author: F. Bry and J. Bailey
   Lecture hours: 4
   Classification: IM1, IM2, WT1, SW1

   Retrieving data from the Web is often difficult because of the Web's size, heterogeneity, and decentralized structure. Techniques of various kinds have been developed to ease data retrieval on the Web. One of the approaches followed in research and industry is to develop query languages specific to the Web that are inspired by traditional database query languages (such as SQL). The work on Web query languages can be described in four categories, each corresponding to languages of a certain kind. In the first category, elementary "data selection languages" (XPath and XPointer) have been developed that allow simple selection queries referring to a single Web page. In the second category, more sophisticated languages which allow more complex queries referring to several Web pages have been developed. These languages were developed first by the research community and then standardized by bodies such as the W3C. The two principal languages in this category are XQuery and XSLT and they have distinct, yet similar purposes. XQuery can be seen as a natural extension of database query languages like SQL to XML, while XSLT is primarily concerned with document transformation. The third category, which has been developed in parallel with the second category, is concerned with positional querying and contains many open research issues. The fourth category of languages has only recently begun to emerge and deals with the ability to query and process metadata on the Semantic Web. This course aims at introducing Web languages from each of the four above-mentioned categories. Special attention will be devoted to standards (XPath,

XPointer, XQuery, and XSLT) and to Semantic Web query languages.

6. Evolution and Reactivity for the Web and the Semantic Web
   Author: W. May and J. J. Alferes
   Lecture hours: 4
   Classification: IS1, IM2, WT1, SW1

   The course will present a vision of the Web and the Semantic Web as a "living organism" combining autonomously evolving data sources, each of them reacting to events it perceives. Rather than a Web of data sources a Web of Information Systems is envisaged. Each such system, besides being capable of gathering information, is capable of updating persistent data, communicating the changes, requesting the changes in other systems, and being able to react to requests from other systems. The dynamic character of such a Web requires declarative languages and mechanisms for specifying the evolution of the data.

   This course will discuss foundations of evolution and reaction languages in general, and some specific issues posed by evolution and reactivity in the Web and in the Semantic Web.

   The addressed topics include: Logics for updates and State Change, Event Languages and Event Algebras, Rule-based languages for evolution and actions, Event-Condition-Action rules in databases, Existing languages for updates of XML data, Concepts and requirements for evolution in the Web. They will be illustrated by examples and use cases.

7. Personalization for the Semantic Web
   Author: M. Baldoni, C. Barolio and N. Henze
   Lecture hours: 4
   Classification: IM3, WT5, SW1

   Various techniques for personalizing the access to web information have been developed in the past. Most prominently, techniques for personalizing the hypertext structure have been exploited (research field of adaptive hypermedia), and techniques for using access strategies and patterns of users for recommending content to other users (research field: recommender systems) have been developed, tested, and successfully implemented.

   The first part of the course will give a brief introduction into the field of adaptive hypermedia and recommender systems, and will discuss standard techniques in both areas. The huge amount of information on the web raises the need of more sophisticate tools to access it and of more sophisticate tools to organize it. Semantic Web suggests a way to achieve these goals. In other words, Semantic Web allows the users to access information on the net in a personalized way, so as to satisfy their needs, goals, and preferences. Reasoning on information allows to capturing the right thing at the right moment. The second part of the course will discuss how personalized information systems can use and profit from semantic information in a distributed environment, what the key problems to solve are, and which approaches exist currently.

8. Information Extraction for the Semantic Web
   Author: R. Baumgarten, T. Eiter, G. Gottlob, M. Herzog and C. Koch
   Lecture hours: 1
   Classification: IM1, WT2, SW1

The World Wide Web represents a universe of knowledge and information. Unfortunately, it is not straightforward to query and access the desired information. Languages and tools for accessing, extracting, transforming and syndicating the desired information are required. The Web should be useful not merely for human consumption but additionally for machine communication. Therefore, powerful and user-friendly tools based on expressive languages for extracting and integrating information from various different Web sources, or in general, various heterogeneous sources are needed. The tutorial gives an introduction to Web technologies required in this context, and presents various approaches and techniques used in information extraction and integration. Moreover, sample applications in various domains will motivate the discussed topics and providing data instances for the Semantic Web will be illustrated.

9. Programming with Logic and Objects
   Author: M. Kifer
   Lecture hours: 1
   Classification: IS1, IM1, IM2, SW3, SW4

   The tutorial will survey the foundations of knowledge representation and reasoning on the Semantic Web, which integrates Frame Logic, HiLog and Transaction Logic.

   Frame Logic relates to the object-oriented data model as classical predicate calculus relates to the relational data model. HiLog enhances the meta-programming capabilities, and Transaction Logic adds database dynamics to the mix.

   The tutorial will also discuss a particular implementation of these ideas in the FLORA-2 system, which has recently become a popular tool for representing ontologies on the Semantic Web. Many elements of FLORA-2 are being incorporated in the design of the rules languages underlying SWSI and WSMO – two important projects in the area of Semantic Web Services.

5 Summary and Discussion

As a first step towards development of curricula recommendation for the Semantic Web we presented a proposal for structuring of the domain, based on the analysis of the material in deliverable E-D1, surveying existing university courses relevant for the Semantic Web education. The proposed structure refers to some areas covered by IEEE/ACM Computer Science curriculum, and identifies new ones, specific for the Semantic Web. The proposed structure will be subject of further discussion with the ET group of REWERSE, with the Educational Area of Knowledge Web and with the management of the Erasmus Mundus Supported European Master's Program in Computational Logic. A revised and extended version of this structure will be used as a basis for a draft recommendation for Semantic Web graduate curriculum (deliverable E-D7 planned for month 24).

We initiated an effort to develop REWERSE introductory courses addressing a broad selection of the topics identified in the preliminary structure. This effort resulted in a list of courses presented in this document with commitments of REWERSE partners to develop electronic learning materials for inclusion in VISWER. The materials will be used at the REWERSE Summer School in July 2005, and are to be included in VISWER before the Summer School.

We notice that the courses described in this document address a majority of topics of the structure. They are of introductory nature, with the objective to disseminate the basic ideas of

the Semantic Web to a broad population of graduate students and researchers. The introductory e-learning material to be developed for that purpose will be evaluated by the REWERSE TTA group, for its usefulness for dissemination of Semantic Web ideas in industry.

The need for more advanced and specialized graduate courses has to be analyzed in the continuation of the curriculum work.

None of the courses of the presented list is specifically devoted to Semantic Web applications. The reason for that is the decision to provide first a general introduction to the Semantic Web, where application will be mentioned but not studied in-deep. Notwithstanding importance of applications, the second round of development of the e-learning materials in year 2 of REWERSE will prioritize courses addressing application aspects.

This work is to be done in parallel with revision and refinement of the proposed structure.

A Collection of courses - E-D1

A.1 Long courses

- Agent-Based Internet Computing,
  M. Koubarakis, Technical University of Crete, Greece

- Artificial Intelligence and Machine Learning,
  A. Martelli, Universita degli Studi di Torino, Italy

- Computational Logics,
  E. Franconi, Free University of Bozen-Bolzano, Italy

- Constraint Programming,
  F. Fages, INRIA, France

- Constraint Reasoning and Programming,
  S. Abdennadher, German University in Cairo, Egypt

- Course on Ontologies,
  F. Gandon, INRIA, France

- Database Technology,
  M. Berndtsson, Högskolan i Skövde, Sweden

- Description Logics,
  E. Franconi, Free University of Bozen-Bolzano, Italy

- DLs for Conceptual Design, Information Access, and Ontology Integration,
  E. Franconi, Free University of Bozen-Bolzano, Italy

- Foundations of the Semantic Web,
  V. Haarslev, Concordia University, Montreal, Canada

- Foundations of the Semantic Web and Ontology Management,
  G. Lukacsy, Budapest University of Technology and Economics, Hungary

- Global Information Systems,
  A. Sheth, University of Georgia, U.S.A.

- Hypertext and Web Technologies,
  L. Carr, University of Southampton, UK

- Information Retrieval, Hypermedia and the Web,
  C. Goble, The Victoria University of Manchester, UK

- Integrated Logic Programming,
  M. Schroeder, Technische Universitt, Dresden, Germany

- Intelligent Agents: modeling and reasoning techniques,
  A. Martelli, Universita degli Studi di Torino, Italy

- Intelligent Systems in WWW (Intelligente Systeme im WWW),
  M. Völkel, Universität Karlsruhe, Germany

- Introduction to Human Language Technology for the Semantic Web,
  H. Cunningham, University of Sheffield, UK

- Introduction to the Semantic Web,
  J. Hardin, University of Michigan, U.S.A.

- Issues on Knowledge Representation on the Web,
  C. Damasio, Universidade Nova de Lisboa, Portugal

- Knowledge Assisted Multimedia Content Analysis Using Semantic Web Technologies,
  Y. Kompatsiaris, Centre for Research and Technology Hellas, Greece

- Knowledge Base Programming with Frames and Logic,
  M. Kifer, University of New York, U.S.A.

- Knowledge Management on the Web,
  G. Antoniou, University of Crete, Greece

- Knowledge Representation and Reasoning,
  U. Sattler, The Victoria University of Manchester, UK

- Knowledge management,
  Max Völkel, Universität Karlsruhe, Germany

- Laboratory of Web Applications,
  A. Martelli, Universita degli Studi di Torino, Italy

- Lectures on Semantic Web,
  M. Lanzenberger, Vienna University of Technology, Austria

- Logic for Computer Scientists,
  F. Bry, Ludwig-Maximilians-Universität München, Germany

- Logic Programming,
  U. Nilsson, Linköpings universitet, Sweden

- Logics for Computer Science,
  A. Martelli, Universita degli Studi di Torino, Italy

- Logics for knowledge representation and reasoning,
  L. Serafini, Universita di Trento, Italy

- Logics for the Web,

  P. Lambrix, Linköpings universitet, Sweden

- Metadata, Ontology and the Semantic Web,

  W. Wei Song, Peking University, China

- Models of knowledge representation,

  P. Bouquet, Universita di Trento, Italy

- Nonmonotonic reasoning and security,

  P. Bonatti, Universita di Napoli, Italy

- Ontology in a Nutshell,

  F. Gandon, INRIA, France

- RDF for the Semantic Web,

  O. Corby, INRIA, France

- Security and privacy,

  P. Bonatti, Universita di Napoli, Italy

- Semantic Web,

  N. Henze, Universität Hannover, Germany

- Semantic Web,

  G. Wagner, Eindhoven University of Technology, The Netherlands

- Semantic Web,

  A. Sheth, University of Georgia, U.S.A.

- Semantic Web, B. Wielinga, University of Amsterdam, The Netherlands

- Semantic Web,

  Oxford Brookes University, UK (contact person not available)

- Semantic Web and Intelligent Agents,

  N. Bassiliades, Aristotle University of Thessaloniki, Greece

- Semantic Web Services,

  J. Domingue, The Open University, Milton Keynes, UK

- Semantic Web Techniques,

  B. Spencer, University of New Brunswick, Canada

- Semantic Web: Models and Query Languages,

  I. Cruz, University of Illinois at Chicago, U.S.A.

- Semistructured Data,
  R. Baumgartner, Vienna University of Technology, Austria

- Semistructured Data and XML,
  W. May, Universität Göttingen, Germany

- Software Agents,
  M. Schroeder, Technische Universität, Dresden, Germany

- Technologies of the Web based Information Systems,
  J. Aparicio, Universidade Nova de Lisboa, Portugal

- The Intelligent Internet,
  N. Kushmerick, University College Dublin, Ireland

- The Semantic Web,
  J. Heflin, Lehigh University, Bethlehem, U.S.A.

- The Semantic Web,
  J. Hendler, Semantic Web and Agents Research, Maryland, U.S.A.

- The Semantic Web: Ontologies and OWL,
  I. Horrocks, University of Manchester, UK

- Web Data Management,
  V. Christophides, University of Crete, Greece

- Web-based Knowledge Representation,
  F. van Harmelen, Vrije Universiteit Amsterdam, The Netherlands

- XML and Databases,
  F. Bry, Ludwig-Maximilians-Universität München, Germany

A.2   Short courses

- A three hour introduction to XML,
  M. Ronchetti, Universita di Trento, Italy

- An Introduction to Semantic Web Technologies,
  K. Ahmed, Techquila, UK

- Brief introduction to ANT,
  M. Ronchetti, Universita di Trento, Italy

- Brief introduction to JNDI,
  M. Ronchetti, Universita di Trento, Italy

- Introduction to business rules,
  S. Spreeuwenberg, LibRT, The Netherlands

- Semantic Web Information Day,
  R. Tolksdorf, Freie Universität Berlin, Germany