



E-D13

Final Report on ET Educational Effort

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Abstract

This document summarizes the results of the REWERSE Education and Training (ET) Activity. It briefly presents the main durable effects of ET: the annual Summer School “Reasoning Web”, the REASE repository of e-learning materials, and the hierarchy of the Semantic Web topics used as a guideline for defining Semantic Web curricula. The document is an executive summary with references to other resources with detailed information.

Keyword List

Semantic Web, education and training

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This document summarizes the results of the REVERSE Education and Training (ET) Activity. It briefly presents the main durable effects of ET: the annual Summer School “Reasoning Web”, the REASE repository of e-learning materials, and the hierarchy of the Semantic Web topics used as a guideline for defining Semantic Web curricula. The document is an executive summary with references to other resources with detailed information.

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Contents

1	Introduction	1
2	The Annual Summer School on Web Reasoning	1
2.1	The Objectives	1
2.2	Organizational Structure	2
2.3	Summer Schools during REWERSE lifetime	2
2.4	Summer Schools after REWERSE	3
3	Establishing REASE, the Repository of E-learning Materials	3
3.1	Objectives	3
3.2	REASE	3
3.3	EASE: The European Association for Semantic Web Education	4
4	Semantic Web Topic Hierarchy and Curricula	4
4.1	The Objectives	4
4.2	The Semantic Web Topic Hierarchy	4
4.3	The European Academy for Semantic-Web Education	8
5	Contribution of ET to other REWERSE dissemination activities	8
6	Conclusions	9

1 Introduction

This document summarizes the results of the REWERSE Education and Training (ET) Activity during the REWERSE lifetime. According to the contractual documents, the objective of the activity ET is to contribute to a durable educational structure in the field of the Semantic Web by:

- Establishing and running the annual Summer School on web reasoning,
- Co-operating with NoE Knowledge Web on establishment of the e-learning infrastructure for Semantic Web education, and by contributing learning materials to it,
- Development of the recommendations for the Semantic Web graduate curriculum and supporting it by courses/programmes.

The rest of this document shows how the abovementioned goals were achieved during the lifetime of REWERSE and presents the durable educational structures created by REWERSE for the continuation of the educational activities after the end of REWERSE.

2 The Annual Summer School on Web Reasoning

2.1 The Objectives

The advanced capabilities required in most Semantic Web application scenarios primarily call for reasoning. Reasoning capabilities are offered by Semantic Web languages that are currently being developed. Most of these languages, however, are developed mainly from functionality-centered perspectives (e.g., ontology reasoning or access validation) or application-centered perspectives (e.g., Web service retrieval and composition). A perspective centered on the reasoning techniques (e.g. forward or backward chaining, tableau-like methods, constraint reasoning, etc.) complementing the above-mentioned activities appears desirable for Semantic Web systems and applications.

Just as the current Web is inherently heterogeneous in data formats and data semantics, the Semantic Web will be inherently heterogeneous in its reasoning forms. Indeed, any single form of reasoning turns out unrealistic in the Semantic Web. For instance, ontology reasoning in general relies on monotonic negation, while databases, Web databases, and Web-based information systems employ non-monotonic reasoning; constraint reasoning is used in dealing with time, while forward and/or backward chaining is the reasoning of choice in coping with database-like views.

In 2005 the REWERSE ET activity started the series of annual Summer Schools Reasoning Web. The objective of the Reasoning Web Summer School is to provide coherent introductions to various topics related to Semantic Web reasoning. The audience targeted are young professionals working in the field of the Semantic Web. The focus and the selected topics covered each year may vary. The attempt is made to follow developments in the field and to provide up-to-date tutorials on recent important results in addition to well-structured introductions. The tutorial volume is to be published in advance every year, to provide coherent teaching materials for the participants and to assure a durable effect. In addition, the slides of the lectures are to be uploaded to the REASE repository of Semantic Web e-learning materials (cf. Section 3).

2.2 Organizational Structure

In order to assure the continuation of Reasoning Web beyond the lifetime of REWERSE, ET worked out an organizational structure described in the Summer School Charter approved by the REWERSE Steering Committee. According to the charter the Summer School is run by the Summer School Board, originally appointed by the REWERSE Steering Committee from among REWERSE members. The membership is time-limited and new members are elected by the current Board from researchers active in the field of Semantic Web. For every edition of the School the Board appoints the PC Chair and the Local Organization Chair. The PC Chair is responsible for forming a small Program Committee to be approved by the Board. The PC decides on the focus of the Summer School edition, invites the speakers, works out the call for participation and the final programme. It is also responsible for publication of the materials and for selection of participants from all submitted application.

For further details the reader is referred to the public (optional) REWERSE deliverable E-Dx1 “Reasoning Web: Summer School Board and Charter”.

2.3 Summer Schools during REWERSE lifetime

During REWERSE lifetime there were three editions of the Summer School:

1. Reasoning Web 2005, Malta July 2005
 - Organized by the REWERSE participant Malta,
 - No formal PC, the programme work done by ET coordinator and deputy coordinator,
 - Tutorial material published by Springer-Verlag LNCS 3564,
 - Lecture slides available in the REASE repository,
 - 72 applications ($\sim 50\%$ REWERSE related),
43 accepted participants ($\sim 60\%$ REWERSE related),
 - for more details see REWERSE deliverables E-D3 and E-D8-1.
2. Reasoning Web 2006, Lisbon September 2006
 - Organized by the REWERSE participant Lisbon,
 - PC Chair Francois Bry, REWERSE participant Munich,
 - Tutorial material published by Springer-Verlag LNCS 4126,
 - Lecture slides available in the REASE repository,
 - 89 applications ($\sim 20\%$ REWERSE related),
43 accepted participants ($\sim 30\%$ REWERSE related),
 - for more details see REWERSE deliverables E-D8-1 and E-D8-2.
3. Reasoning Web 2007, Dresden September 2007
 - Organized by the REWERSE participant Dresden,
 - PC Chair Nicola Henze, REWERSE participant Hannover,
 - Tutorial material published by Springer-Verlag LNCS 4636,
 - Lecture slides available in the REASE repository,

- 79 applications (~21% REWERSE related),
63 accepted participants (~24% REWERSE related),
- for more details see REWERSE deliverables E-D10-1 and E-D12.

2.4 Summer Schools after REWERSE

The Summer School Board already decided on the organization of two Summer Schools after REWERSE, as listed below, and will take care of further future events:

1. Reasoning Web 2008, Venice September 2008
 - Organized by the REWERSE participant Venice at San Servolo Island, Venice,
 - PC Chair Piero Bonatti, REWERSE participant Naples,
 - The programme decided in Fall 2007,
 - Springer-Verlag agreed to publish the material as LNCS volume,
 - Call for participation issued in February.
 - for more details see REWERSE deliverable E-D12.
2. Reasoning Web 2009, Bozen-Bolzano September 2009
 - to be organized by the University of Bozen-Bolzano,
 - PC Chair Enrico Franconi, University of Bozen-Bolzano.

3 Establishing REASE, the Repository of E-learning Materials

3.1 Objectives

The objective was to create a technical infrastructure which makes it possible to store and to give access to e-learning materials on the Semantic Web and to assure submission of up-to-date quality content. The effort was undertaken as a joint initiative of Knowledge Web and REWERSE.

3.2 REASE

REASE, the repository for learning units in the area of Semantic Web, is the result of the initiative addressing the above stated objectives. REASE has been created as a joint effort of the European Networks of Excellence KnowledgeWeb and REWERSE. It will be continued under the auspices of the European Association for Semantic Web Education (cf. Section 3.3). REASE is based on the EducaNext platform, which was initially developed in the European Project UNIVERSAL and is has been continued in the European Project PROLEARN. REASE comprises a diverse collection of learning resources, such as slide sets from lectures, tutorials, videos, self-running demonstrations, or pointers to educational activities for both Higher Education as well as for industrial education. REASE is open to any member of the academic, research, or professional community.

REASE resources can be found as follows:

- By browsing the REASE catalogue (available in the Browse dialog). The catalogue is based on the Semantic Web Topic Hierarchy (cf. Section 4.2) developed by REWERSE and Knowledge Web. The results can also be filtered, e.g., according to the target audience (academics vs. professionals from industry).
- By viewing the list of most popular resources.
- By performing a full text search using the search box in the center of the main page or the Advanced Search dialogue.

For getting full access to all resources registration is required. Registered users are also able to upload own educational resources. The resources submitted to REASE are subject to quality control. For more details see REWERSE deliverable E/T-D14.

In December 2007 the number of REASE resources exceeded 200 out of which approximately one third were produced by REWERSE members. In that time REASE had more than 600 registered users and more than 300 registered institutions from all over the world. These numbers were continuously growing (see REWERSE deliverable E/T-D14).

3.3 EASE: The European Association for Semantic Web Education

The durability of the joint educational initiatives of REWERSE and Knowledge Web is assured by the European Association for Semantic Web Education (EASE). EASE is a non-profit organization established in June 2007. The main activities of EASE are currently:

- Hosting REASE (cf. Section 3), the repository of EASE for learning resources around Semantic Web topics (Section 4.2).
- Supporting the European Academy for Semantic-Web Education (Section 4.3).

4 Semantic Web Topic Hierarchy and Curricula

4.1 The Objectives

The objective of this work was to develop Semantic Web curricula and to implement them by academic courses offered by REWERSE participants. A necessary step towards this objective was to identify a structure of the body of knowledge within the field of the Semantic Web, to be called the Semantic Web Topic Hierarchy. In the rest of this section we summarize the work done by ET towards achievement of these objectives.

4.2 The Semantic Web Topic Hierarchy

The development of the Semantic Web Topic Hierarchy was initiated in REWERSE by an analysis of the Semantic Web related courses offered by the universities worldwide at the time of the start of REWERSE. The collected information and the initial proposal for the hierarchy is documented in the REWERSE deliverable E-D1 in year 2004. Subsequently, the proposal became a subject of discussion and cooperation with Knowledge Web. It has undergone several changes and versions, as more people started to contribute to the discussion of the topic hierarchy and also because the ‘Semantic Web’ research area developed over time during the years 2004–2007, when the topic hierarchy was initiated.

The most recent version of the hierarchy (Version 2) is enclosed as table 1. It is also posted at the web at http://ontoworld.org/wiki/Semantic_Web_Topic_Hierarchy. It has been used for development of the curriculum of the European Academy for Semantic-Web education (see Section 4.3). Its flattened version is used as a catalogue for e-learning resources in REASE (see Section 3). For more details concerning the hierarchy and its use see REVERSE deliverable E-D11.

Table 1: The Semantic Web Topic Hierarchy, Version 2

1 Foundations	
1.0 Knowledge Engineering/ Ontology Engineering	1.4 Agents
1.0.1 Ontology Engineering Methodologies	1.5 Natural Language Processing
1.0.2 Ontology Construction / Ontology Learning	1.6 Security / Trust / Privacy
1.0.3 Ontology Evolution / Ontology Population	1.7 Machine learning
1.0.4 Ontology Mapping / Ontology Translation / Ontology Matching / Ontology Aligning (Heterogeneity)	1.8 Rules
1.0.5 Ontology Evaluation / Ontology Validation	1.8.1 Deductive Rules
1.0.6 Ontology Interoperability / Ontology Integration / Ontology Merging	1.8.2 Reactive Rules
1.0.7 Ontology Modularization / Ontology Composition	1.8.1 Rule Visualization
1.0.8 Ontology Engineering Tools	1.9 Information Access
1.0.9 Ontology Visualization	1.9.1 Query Languages
1.1 Knowledge Representation and Reasoning	1.9.2 Browsing / Navigational Access
1.1.1 Logics	1.9.3 Query Algebra
1.1.1.2 Description Logics	1.9.4 Query Optimization
1.1.1.3 F-Logic	1.9.5 Visual Querying
1.1.1.5 First-Order Logic	1.9.6 Event Queries
1.1.1.6 Temporal Logics	2 Semantic Web Core topics
1.1.1.7 Fuzzy Logic	2.2 Semantic Web Information Access
1.1.2 Logic Programming	2.2.1 Semantic Web Query Languages
1.1.2.1 Horn Logic	2.2.3 Semantic Web Browsing
1.1.2.2 Datalog	2.3 Ontology on the Semantic Web
1.1.2.3 Prolog	2.3.1 OWL
1.1.2.4 Hilog	2.3.4 Resource Description Framework / RDFSchema
1.1.2.4 Monotonic and Nonmonotonic Negations	2.3.5 Legacy Ontology Languages (DAML, DAML+OIL)
1.1.3 Reasoning	2.3.6 Ontology Repositories
1.1.3.1 Reasoning Engines / Theorem Provers	2.3.7 Ontology Instances
1.1.3.2 Fuzzy Reasoning	2.3.7.1 Upper-Level Ontologies / Top-Level Ontologies
1.3 Basic Web Information Technologies	2.3.7.2 Domain Ontologies
1.3.1 XML	2.3.7 Semantic Annotation / Microformats
1.3.2 Web Data Integration	2.4 Web and Semantic Web Rules
1.3.4 Web Services	2.4.1 Rule Languages
1.3.4.1 Web Service Discovery	2.4.2 Rule Markup
1.3.4.2 Web Service Composition	2.4.5 Integration of Rules and Ontologies
1.3.5 Personalization Techniques	2.4.6 Distributed Rule Processing
1.3.6 Web Data Extraction / Information Extraction	2.7 Semantic Web Application Domains
	2.7.1 Knowledge Management
	2.7.2 e-learning
	2.7.3 Bioinformatics
	2.7.4 Multimedia
	2.7.5 e-health
	2.7.6 e-business
	2.7.9 e-government
	2.7.10 Information Retrieval / Search
	2.7.11 e-culture
	2.7.12 Human resources
	2.7.13 Blogs

- 2.7.14 Business Rules
- 2.7.15 Wikis
- 2.7.16 Digital Libraries
- 2.7.17 Data Integration /
 - Enterprise Information Integration
- 2.8 Reasoning in the Semantic Web
- 3 Semantic Web Special Topics
 - 3.1 Natural Language Processing /
 - Human Language Technologies
 - 3.2 Social Impact of the Semantic Web
 - 3.3 Social Networks and Semantic Web
 - 3.4 Peer-to-Peer and Semantic Web
 - 3.5 Agents and Semantic Web
 - 3.6 Semantic Grid
 - 3.7 Outreach to Industry
 - 3.8 Benchmarking and Semantic Web Scalability
 - 3.10 Semantic Web Services
 - 3.11 Semantic Desktop

4.3 The European Academy for Semantic-Web Education

In 2006 the European Networks of Excellence Knowledge Web and REWERSE have launched the European Academy for Semantic-Web Education (<http://www.semantic-web-academy.eu/>), an international distributed Master of Science program, in cooperation with leading European universities, all known for excellence in the field of Semantic Web:

- Free University of Bozen-Bolzano, Italy (initial coordinator)
- University of Innsbruck, Austria (coordinator since end of 2007)
- Vrije Universiteit Amsterdam, The Netherlands
- Universidade Nova de Lisboa, Portugal
- Universidad Politécnica de Madrid, Spain
- Università di Trento, Italy

The European Academy for Semantic-Web Education, completely in English, involves studying one year at one of the above universities, and completing the second year while staying at one of the other partner universities. After this, the student may obtain, together with the European degree, a national Master of Science degree for each of the visited universities (e.g., in Italy this would be the Laurea Specialistica degree).

The program of the Academy has been developed using the Semantic Web Topic Hierarchy and the course descriptions have been classified by the topics of the hierarchy. For details concerning the modules offered by Knowledge Web participants see Knowledge Web deliverable D3.2.4. REWERSE will contribute to the Academy with the courses developed by Universidade Nova de Lisboa. They focus on Logic Technologies and Applications and on Distributed, Parallel Web and Grid Computing. For details see REWERSE Deliverable E-D11. In the final stage of REWERSE the “Agreement of Cooperation” between involved universities was being signed by the respective officials. They extend the courses already offered by Lisbon in the Erasmus Mundus supported European MSc in Computational Logic.

5 Contribution of ET to other REWERSE dissemination activities

ET has been involved in the creation of the annual International Conference on Web Reasoning and Rule Systems (RR). The conference was launched in 2007 as a merge of three separate events, negotiated with involvement of ET. One of the merged events, the International Annual Workshop on Principles and Practice of Semantic Web Reasoning (PPSWR) was started in 2003 with involvement of ET members, just before the official start of REWERSE.

ET cooperated with the REWERSE Technology Transfer activity on industrial dissemination, in particular on creation of the infrastructure for it (see joint ET/TTA deliverables E/T-D9 and E/T-D14) and on creation of courses for industry (see TTA deliverables T-D3, T-D5, T-D7 and T-D11).

6 Conclusions

This report summarizes the main results of the REWERSE ET activity during the lifetime of REWERSE. They consist of

- The series of annual Summer Schools Reasoning Web,
- The REASE repository of e-learning materials,
- The Semantic Web Topic Hierarchy,
- The courses offered by REWERSE participant Lisbon in the curriculum of the European Academy for Semantic-Web education, based on the Semantic Web Topic Hierarchy.

and thus fulfill the contractual obligations of ET. The results have a durable effect on the Semantic Web community:

- The Summer Schools are/will be run in the future by the Summer School Board founded by REWERSE.
- REASE and the European Academy for the Semantic-Web Education will be run by the European Association for the Semantic Web Education founded jointly by Knowledge Web and REWERSE,
- The Semantic Web Topic Hierarchy provides a stable reference for future work on the Semantic Web curricula.

The results were achieved by close cooperation of many REWERSE participants, who provided the high quality unique learning materials to Summer Schools and to REASE, organized the Summer Schools, participated in the creation of the Semantic Web Topic Hierarchy and developed Semantic Web courses. The close cooperation with Knowledge Web made it possible to create and to maintain REASE, to undertake the initiative of the European Academy for the Semantic-Web Education and to develop jointly the Semantic Web Topic Hierarchy.