

## REasoning on the WEb with Rules and SEmantics

The objective of REWERSE is to establish Europe as a leader in reasoning languages for the Web by

- networking and structuring a scientific community of more than 100 researchers from 27 participating institutions in 14 different European countries
- providing tangible technological bases that do not exist today for an industrial software development of advanced Web systems and applications.

### Impact

The community networked and structured by REWERSE

- develops a coherent and complete, yet minimal, collection of inter-operable reasoning languages for advanced Web systems and applications;
- tests these languages on context-adaptive Web systems and Web-based decision support systems selected as test-beds for proof-of-concept purposes;
- brings the proposed languages to the level of open pre-standards amenable to submissions to standardisation bodies such as the W3C.

To foster durable impact REWERSE implements Education and Training activities targeted at Universities as well as Technology Transfer and Awareness activities targeted at the European industry. As a W3C member REWERSE is involved in various standardisation activities.

### REWERSE's main innovation

For the full exploitation of the Semantic Web it is necessary not only to describe meta-data but also provide languages and methods to query and to automatically *reason* over these data, i.e. to derive new not explicitly stated information from existing data using various forms of *rules*. The European Network of Excellence REWERSE develops rule-based languages and applications to process, query and to automatically reason over Web data. REWERSE's technologies thus enhance today's conventional Web towards a more intelligent "Semantic Web". REWERSE's focus on rules and reasoning on the Web enhances existing Semantic Web efforts that mainly deal with the representation of semantic information.

More concretely, REWERSE is developing a format, or markup, for rule languages (I1), approaches to specifying policies, i.e. high-level specifications for complex Web systems (I2), methods for composing and typing Web rule and query languages (I3), a query language for Web and Semantic Web data (I4), rule-based approaches to specifying reactive behaviours of Web systems (I5). In addition, REWERSE develops methods for expressing and processing temporal and location data (A1), semantic approaches to Bioinformatics (A2), and methods for personalisation (A3).

## REWERSE's results so far

The focus of REWERSE is the definition of languages and support tools for reasoning on the Web and the application of these technologies in different application domains. In its first months REWERSE has defined requirements and base components for the different technologies accompanied by thorough state-of-the-art surveys. At the end of year one use cases for the respective technologies have been defined that all require rules and reasoning for satisfactory realisation. In year 2 REWERSE has been implementing first results of the respective technologies. In year 3 REWERSE has consolidated the language definitions and has implemented fully functional prototypes.

The REWERSE research oriented working groups I1-I5 have in particular defined the following languages and demonstrators:

**I1 Rule Modeling and Markup:** *R2ML*, the REWERSE Rule Markup Language, and *URML*, a UML-based visual Rule Modelling language with the visualisation tool *Strelka*. Furthermore, *translators from and to R2ML*, and a *Web service for Rule Interchange* complement the tool support.

**I2 Policies:** *Protune* (Provisional trust negotiation), the trust and policy negotiation framework of REWERSE, *Protune-X*, Protune's explanation facility, and *ACE* (Attempto Controlled English), a controlled natural language for knowledge representation.

**I3 Composition and Typing:** *XcerptT*, a typing system for Xcerpt, type systems for bioinformatics languages, and the *Reuseware Composition Framework* toolset which provides composition technology specifically for languages in the context of the Semantic Web, such as OWL, Xcerpt, and XQuery.

**I4 Reasoning-aware Querying:** Refinement of syntax, semantics and design of *Xcerpt*, a versatile rule-based Web query language, progress on *AmaXoS*, an abstract machine implementation for *Xcerpt* that aims at efficiency, scalability and ease of deployment, and the prototype *divhex*, a reasoner for HEX-programs with the goal to neatly extend existing ontologies with rules and reasoning.

**I5 Evolution and Reactivity:** Implementation of the prototypes *MARS* (*Modular Active Rules for the Semantic Web*) and *r3* (*Resourceful Reactive Rules*) both of which provide a general framework for dealing with evolution and reactivity on the Web, and a stable prototype for *XChange*, a declarative high-level reactivity language (enhancing Xcerpt).

The application groups A1 to A3 have further developed the following languages and prototypes demonstrating advanced Web applications using rules and reasoning:

**A1 Time and Location:** Development of a general software architecture for both, geotemporal and geospatial information processing: the *CTTN system* (Computational Treatment of Temporal Notions) with the language *GeTS* (GeoTemporal Specification Language), its spatial counterpart, the *CTSN system* (Computational Treatment of Spatial Notions) with its language *MPLL* (multiparadigm locational language), and a number of below listed peripheral systems and applications showcasing main results.

**A2 Bioinformatics Semantic Web:** *GoPubMed*, an intelligent biomedical literature search engine, and *MeshPubMed* which uses the MeSH Ontology to perform a semantic search on millions of PubMed articles. The systems *SAMBO*, *KitAMO* and *KitEGA* have been implemented for aligning, merging and grouping biomedical ontologies. Release 2.6 of the Biochemical Abstract Machine *BIOCHAM* for rule-based

modeling biochemical systems, and further applications. The prototype GoPubMed developed by the A2 Bioinformatics group has led to the spin-off of Transinsight GmbH, which received seed funding by the Hightech Gründerfonds in Germany.

**A3 Personalized Information Systems:** the *Personal Reader (PR) Framework*, which implements a service-based architecture for providing various personalization functionalities on the Semantic Web; developed applications using the PR framework are the award-winning *Personal Publication Reader*, a *personal reader for E-learning*, the *Personal Reader Agent* with the new applications *MyEar* and *MyNews*, the *Semantic Portal* for REVERSE and others.

The research results can be followed on <http://reverse.net>; in particular the results are documented in the deliverables and research publications available at <http://reverse.net/publications.html>. At month 36 REVERSE members have contributed to over 412 internationally reviewed publications showing that REVERSE's focus is perfectly targeted to current research needs. Demonstrations of prototypes developed within REVERSE and explanatory screencasts are available at <http://reverse.net/demos/>.

REVERSE has organised several major dissemination events: Annual Summer Schools "Reasoning Web" (July 2005, Malta, September 2006, Lisbon, September 2007, Dresden), the industry awareness events "Semantic Web Days" (October 2005, Munich, June 2007, Düsseldorf, September 2007, Graz) and the research workshops "Principles and Practice of Semantic Web Reasoning" (PPSWR'05) (December 2003, Mumbai, September 2004, St. Malo, September 2005, Dagstuhl, June 2006, Budva). Starting in June 2007 PPSWR together with the events RuleML and RoW have been merged into the "International Conference on Web Reasoning and Rule Systems (RR)". The events are linked at [http://reverse.net/project\\_events.html](http://reverse.net/project_events.html).

Since October 2005 REVERSE holds a consortium membership in the W3C and has a dedicated standardisation task force. REVERSE members actively participate in standardisation activities, in particular in the W3C Rule Interchange Format Working Group and in the W3C Semantic Web Health Care and Life Sciences Interest Group (HCLSIG). Since January 2007 REVERSE also participates in the Semantic Web Education and Outreach Interest Group (SWEO). Details of the standardisation activities can be followed at <http://reverse.net/standardization.html>.

### **REVERSE's upcoming work**

In summary, in its first 3 years REVERSE has proved to be a highly productive research-oriented Network of Excellence (NoE) on Reasoning on the Web that will be continued in year 4. As a research-oriented NoE REVERSE is an extremely appropriate tool for positioning European Computer Science research in international transfer activities. REVERSE has been the first "joint venture" on rules on the Web which started 2 years before the W3C initiated the RIF activity on this very same field, in which REVERSE is now actively involved. As for dissemination, in particular REVERSE's *Reasoning Web* Summer Schools, the *Semantic Web Days* and the research Workshops *PPSWR* have proven to be excellent platforms for training of young researchers, for spreading novel issues to industry and for bringing various research issues fruitfully together. For the next year REVERSE plans to continue these lines of activities with a particular focus on bringing its results, languages and prototypes to

the public. A further goal will be to initiate activities that guarantee a continuation of some of the activities beyond the formal end of REVERSE.

### More details

- REVERSE Website: <http://reverse.net>
- Deliverables and research publications: <http://reverse.net/publications.html>
- Demos and Screencasts: <http://reverse.net/demos/>
- PR material (e.g. Project Flyer, Workpackage Fact Sheets, Project Presentation, Annual Public Reports): [http://reverse.net/downloads\\_demos/](http://reverse.net/downloads_demos/)
- Press releases: [http://reverse.net/press\\_releases.html](http://reverse.net/press_releases.html)
- Project events, e.g. scientific or technology transfer conferences:
  - Overview: [http://reverse.net/project\\_events.html](http://reverse.net/project_events.html)
  - Reasoning Web Summer School 2005: <http://reasoningweb.org/>
  - Semantic Web Days: <http://www.semantic-web-days.net/>
  - PPSWR: <http://reverse.net/PPSWR/>
  - RR: <http://reverse.net/RR/>
- REVERSE Research and Application Working Groups: <http://reverse.net/workinggroups.html>
- REVERSE Dissemination and Standardisation Activities: <http://reverse.net/activities.html>

### Administrative details

Project Reference	506779
Framework	FP6
Priority	Priority 2, IST
Action Line	Semantic-based knowledge systems
Contract Type	Network of Excellence
Start Date	2004-03-01
End Date	2008-02-29
Duration	48 months
Project Status	Execution
Project Funding	
EU Commission part	5 150 000 Euro
Swiss part	360 720 Euro
Participants	27 from 14 European countries
WWW	<a href="http://reverse.net">http://reverse.net</a>

### List of participants

Short Name	Full Name	Country
Munich	Ludwig-Maximilians-Universität München	Germany
Bucharest	Institutul National de Cercetare-Dezvoltare in Informatica	Romania
Edinburgh	Heriot-Watt University, Edinburgh	United Kingdom
Cottbus	Brandenburg University of Technology at Cottbus (BTU Cottbus)	Germany

Göttingen	Universität Göttingen	Germany
Hannover	Leibniz Universität Hannover and Learning Lab Lower Saxony	Germany
Heraklion	Foundation for Research and Technology - Hellas	Greece
Freiburg	Albert-Ludwigs-Universität Freiburg	Germany
LibRT	LibRT B.V., Amsterdam	Netherlands
Linköping	Linköpings Universitet	Sweden
Lisbon	Universidade Nova de Lisboa	Portugal
Dresden	Technische Universität Dresden	Germany
Malta	University of Malta	Malta
Manchester	The University of Manchester	United Kingdom
Nancy	INRIA - Unité de Recherche Lorraine (LORIA)	France
Naples	Università di Napoli	Italy
Paris	INRIA Rocquencourt	France
Skövde	Högskolan i Skövde	Sweden
St. Gallen	Universität St. Gallen	Switzerland
Tekniker	Fundación Tekniker, Eibar	Spain
Telefonica	Telefónica Investigación y Desarrollo, Madrid	Spain
Turin	Università degli Studi di Torino	Italy
Venice	Università Ca' Foscari Venezia	Italy
Vienna	Technische Universität Wien	Austria
Warsaw	Instytut Podstaw Informatyki Polskiej Akademii Nauk	Poland
webXcerpt	webXcerpt Software GmbH, München	Germany
Zurich	Universität Zürich	Switzerland

## Contact persons

### Project Management Office

Scientific Co-Ordinator  
 Dr. François Bry, Professor  
<http://reverse.net/~bry/>

Project Manager  
 Dr. Uta Schwertel  
<http://reverse.net/~schwertel/>

Institut für Informatik  
 Ludwig-Maximilians-Universität München  
 Oettingenstraße 67  
 D-80538 München  
 phone: +49 89 2180 9016  
 fax: +49 89 2180 9017

## Events in connection with the project

### 2007

#### Summer School Reasoning Web 2007

3-7 September 2007  
Dresden, Germany  
<http://reasoningweb.org/2007/>



#### RR 2007 (“International Conference on Web Reasoning and Rule Systems”)

7-8 June 2007  
Innsbruck, Austria  
<http://reverse.net/RR/>



#### Semantic Web Days 2007

SWD @ I-Semantics  
5-7 September 2007  
Graz, Austria  
[http://www.semantic-web-days.net/semantics\\_start.htm](http://www.semantic-web-days.net/semantics_start.htm)



SWD @ EBRC  
19-20 June 2007  
Düsseldorf, Germany  
[http://www.semantic-web-days.net/EBRC\\_start.htm](http://www.semantic-web-days.net/EBRC_start.htm)



### 2006

#### Large Events

#### Summer School Reasoning Web 2006

4-8 September 2006  
Lisbon, Portugal  
<http://reasoningweb.org/2006/>



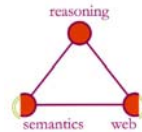
#### Workshop PPSWR 2006 (“Principles and Practice of Semantic Web Reasoning”)

10-11 June 2006  
Budva, Montenegro  
<http://reverse.net/PPSWR06/>



## REVERSE Exhibition at Semantics 2006

28-30 November 2006  
Vienna, Austria  
<http://www.semantics2006.net/>



### *Stands and Tutorials*

“Personal Publication Reader” participates in CeBIT 2006 exhibition

9-15 March 2006  
Hannover, Germany  
<http://www.semantics2006.net/>



Tutorial “Rich Clients need Rich Interfaces: Web-Anfragesprachen für XML und RDF” at XML Tage Berlin, 2006

25-27 September 2006  
Berlin, Germany  
<http://www.berliner-xmltage.de>



Tutorials on “Semantic Web Policies” at ESWC'06 and RuleML'06

11 June, 2006, Budva, Montenegro  
10 November 2006, Athens, Georgia  
<http://cs.na.infn.it/reverse/events.html>



## 2005

### Semantic Web Days 2005

Date: October 6-7, 2005  
Location: Munich, Germany  
www: <http://www.semantic-web-days.net/>  
Type: Technology Transfer to industry – Workshops targeted at industry

### Workshop PPSWR 2005 (“Principles and Practice of Semantic Web Reasoning”).

Date: September 11-16, 2005  
Location: Dagstuhl, Germany  
www: <http://reverse.net/PPSWR05/>  
Type: Research dissemination – Scientific workshop

### Summer School Reasoning Web 2005.

Date: July 25-29, 2005  
Location: Malta  
www: <http://reasoningweb.org>  
Type: Education and Training – Summer School

REWERSE at ESWC 2005 Industry Forum

Date: May 30, 2005

Location: Heraklion

www: <http://rewerse.net/TTA/NewsandEvents/event.htm>

Type: Technology Transfer to industry – Co-organisation of industry forum

REWERSE at CeBIT Future Match Event

Date: March 10-16 2005

Location: Hannover

www: <http://rewerse.net/TTA/NewsandEvents/event.htm>

Type: Technology Transfer – Presentation of REWERSE at Future Match event

## 2004

REWERSE presentation at KM Europe

Date: November 9, 2004

Location: Amsterdam, Netherlands

www: <http://rewerse.net/TTA/NewsandEvents/event.htm>

Type: Technology Transfer – Stand, demos, presentation

Workshop PPSWR 2004 ("Principles and Practice of Semantic Web Reasoning")

Date: September 8-9, 2004

Location: St. Malo, France

www: <http://www.pms.ifi.lmu.de/PPSWR04>

Type: Research dissemination – Scientific workshop

## 2003

Workshop PPSWR 2003 ("Principles and Practice of Semantic Web Reasoning")

Date: December 8, 2003

Location: Mumbai, India

www: <http://www.kbs.uni-hannover.de/~henze/ppswr03/>

Type: Research dissemination – Scientific workshop

Last updated: 30/08/2007