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 (Attempo 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 dlvhex, 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 lead 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 REWERSE and others.

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

REWERSE 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://rewerse.net/project_events.html](http://rewerse.net/project_events.html).

Since October 2005 REWERSE holds a consortium membership in the W3C and has a dedicated standardisation task force. REWERSE 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 REWERSE also participates in the Semantic Web Education and Outreach Interest Group (SWEO). Details of the standardisation activities can be followed at [http://rewerse.net/standardization.html](http://rewerse.net/standardization.html).

**REWERSE’s upcoming work**

In summary, in its first 3 years REWERSE 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 REWERSE is an extremely appropriate tool for positioning European Computer Science research in international transfer activities. REWERSE 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 REWERSE is now actively involved. As for dissemination, in particular REWERSE’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 REWERSE 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 REWERSE.

More details

- REWERSE Website: [http://rewerse.net](http://rewerse.net)
- Deliverables and research publications: [http://rewerse.net/publications.html](http://rewerse.net/publications.html)
- Demos and Screencasts: [http://rewerse.net/demos/](http://rewerse.net/demos/)
- PR material (e.g. Project Flyer, Workpackage Fact Sheets, Project Presentation, Annual Public Reports): [http://rewerse.net/downloads_demos/](http://rewerse.net/downloads_demos/)
- Project events, e.g. scientific or technology transfer conferences:
  - Overview: [http://rewerse.net/project_events.html](http://rewerse.net/project_events.html)
  - Semantic Web Days: [http://www.semantic-web-days.net/](http://www.semantic-web-days.net/)
  - PPSWR: [http://rewerse.net/PPSWR/](http://rewerse.net/PPSWR/)
  - RR: [http://rewerse.net/RR/](http://rewerse.net/RR/)
- REWERSE Research and Application Working Groups: [http://rewerse.net/workinggroups.html](http://rewerse.net/workinggroups.html)
- REWERSE Dissemination and Standardisation Activities: [http://rewerse.net/activities.html](http://rewerse.net/activities.html)

Administrative details

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<td>WWW</td>
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List of participants

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<tr>
<td>Munich</td>
<td>Ludwig-Maximilians-Universität München</td>
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<td>Edinburgh</td>
<td>Heriot-Watt University, Edinburgh</td>
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<td>Cottbus</td>
<td>Brandenburg University of Technology at Cottbus (BTU Cottbus)</td>
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Göttingen University of Göttingen, Germany
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Freiburg Albert-Ludwigs-Universität Freiburg, Germany
LibRT LibRT B.V., Amsterdam, Netherlands
Linköping Linköpings Universität, Sweden
Lisbon Universidade Nova de Lisboa, Portugal
Dresden Technische Universität Dresden, Germany
Malta University of Malta, Malta
Manchester The University of Manchester, United Kingdom
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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
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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://rewerse.net/RR/

Semantic Web Days 2007

SWD @ I-Semantics
5-7 September 2007
Graz, Austria
http://www.semantic-web-days.net/seminatics_start.htm

SWD @ EBRC
19-20 June 2007
Düsseldorf, Germany
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://rewerse.net/PPSWR06/
REWERSE 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/


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/rewerse/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://rewerse.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
REWERENCE at ESWC 2005 Industry Forum  
Date: May 30, 2005  
Location: Heraklion  
www: [http://rewerse.net/TTA/NewsandEvents/event.htm](http://rewerse.net/TTA/NewsandEvents/event.htm)  
Type: Technology Transfer to industry – Co-organisation of industry forum

REWERENCE at CeBIT Future Match Event  
Date: March 10-16 2005  
Location: Hannover  
www: [http://rewerse.net/TTA/NewsandEvents/event.htm](http://rewerse.net/TTA/NewsandEvents/event.htm)  
Type: Technology Transfer – Presentation of REWERSE at Future Match event

2004

REWERENCE presentation at KM Europe  
Date: November 9, 2004  
Location: Amsterdam, Netherlands  
www: [http://rewerse.net/TTA/NewsandEvents/event.htm](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](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/pps03/](http://www.kbs.uni-hannover.de/~henze/pps03/)  
Type: Research dissemination – Scientific workshop