SW@Ukraine

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■ *Executive Summary: The research in the Semantic Web domain in Ukraine is not established well enough so far if examined at the Nation-wide scale. However, some "springs" find their way to the surface of the maturity. 2005 was the year of more intensive uptakes in the area both in fundamental and applied research. The report outlines the whole picture and focuses on the presentation of the Ukrainian research groups which have already received international recognition by collaborating in the international projects, organizing international events in the Semantic Web area, publishing and presenting their results in international scientific journals and at the top conferences. The common feature of the presented teams is that their main emphasis in 2005 is the focus on the research and development in the uptakes funded by the European industrial sponsors. The main objective of the Industrial Ontologies Group at KNURE and Jyvaskyla University is to contribute to the faster adoption of the Semantic Web and the related technologies to local and global industries. It implies the research and development aimed to architect a Global Understanding Environment as the next generation of Web-based platforms by making heterogeneous industrial resources (files, documents, services, devices, business processes, systems, organizations, human experts, etc.) web-accessible, proactive and cooperative in a sense that they will be able to perform intelligent activities in an automated fashion. The focus of the Intelligent Systems Research Group at ZNU is the synergy of the Semantic Web, the Semantic Web Services, agent-based approaches and grids. This synergetic approach in 2005 has been successfully applied in the PSI project funded by Cadence Design Systems, GmbH. Though the government of Ukraine does not distinguish the Semantic Web research among the other important fields it pays substantial attention to it. Several actions of the Ministry of Education and Science of Ukraine and the leading research centers have been undertaken in 2005 to stimulate Semantic Web related research and development, to attract the attention of the local industry. The following two initiatives initiated and supervised by the Ministry may be mentioned: The launch of the Semantic Portal project for the Nation-wide network of Universities and Research Centers and the creation of the Working Group for the development of the Ukrainian Infrastructure for the Electronic Data Interchange among the Academic institutions of the country.*

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1. Semantic Web Research in Ukraine

The research in the Semantic Web domain in Ukraine is not established well enough so far if examined at the Nation-wide scale. The major reason is the lack of the state and the international support of Science in general and the Computer Science and Engineering in particular. However, as one may see from the map in Fig. 1, some "springs" find their way to the surface of the maturity. 2005 was the year of more intensive uptakes in the area both in fundamental and applied research.

Two Ukrainian research groups have international recognition: the Industrial Ontologies Research Group (IOG) at the Department of AI of Kharkov National University of Radioelectronics led by Vagan Terziyan and the Intelligent Systems Research Group (ISRG) at the Department of IT of Zaporizhzhia National University led by Vadim Ermolayev. In addition to them several other research teams from The Institute of Software Systems of the National Academy of Sciences of Ukraine (Prof. Andon), Kherson State University (Prof. Spivakovskiy), Kharkov Karazin National University (Prof. Zholtkevych), Ternopil National Academy of Economy (Prof. Sachenko) have reported on their research and international cooperation in the Semantic Web related fields.

IOG was the most active in 2005 judging by the number of projects, funding raised, research contributions and cooperation nodes both in Ukraine and abroad. The activities of the group were substantially influenced by their industrial collaboration with the constellation of Finnish enterprises and organizations which resulted in the launch and the continuation of several research and R&D projects.
InBCT project (http://www.cs.jyu.fi/ai/OntoGroup/SemanticFacilitator.htm) resulted in the development of the semantic facilitator called the "Semantic Google" for Web Information Retrieval. Idea Mentoring I-II projects (http://www.cs.jyu.fi/ai/OntoGroup/IdeaMentoring1.htm) funded by Nokia and JSP studied the emerging applications for mobile phones based on Semantic Web technology. SCOMA ("Scientific Computing and Optimization in Multidisciplinary Applications") project (http://www.cs.jyu.fi/ai/OntoGroup/scoma.htm) funded by Tekes and Industrial partners developed the prototype of the Semantic Web portal that provides advanced publishing, sharing, and reuse of the mathematical tools, the expertise and the knowledge distributed among the heterogeneous SCOMA parties. SmartResource Tekes project continued the research and development of the large-scale environment for integration of industrial smart-devices, Web Services and human experts based on the Semantic Web, Peer-to-Peer and Agent technologies. The objective of the ASG project (Adaptive Services Grid, (http://asg-platform.org/cgi-bin/twiki/view/Public) is the development of an open platform for adaptive services, discovery, creation, composition, and enactment and the development of an open platform for the European telecommunication industry to faster the roll out of new services and new products. From a business point of view ASG aims to make processes and services more effective and efficient by using semantic information to reply to the user requests, by enabling services provisioning with service components from different platforms and suppliers, by enabling dynamic adaptive service composition and by providing high scalable platform using grid technologies. The approach used in this project is very close to that of the ISRG in RACING and UnIT-Net projects. In Ukraine the IOG took the scientific lead in the launch of the National Semantic Portal for the Network of all Ukrainian Universities and the Ministry of Education and Science of Ukraine (MONU). In 2005 the IOG continued to develop and extend its collaboration with the European nodes of the Semantic Web community: Vrije University of Amsterdam, Tampere University of Technology, Vaasa University and many others. In 2005 the members of the group organized the 1st International IFIP/WG12.5 Working Conference on Industrial Applications of Semantic Web (Jyvaskyla, 25-28 August, 2005,[1]).

The research and development activities of the ISRG in 2005 were focused to one National and two International projects. The RACING project (http://www.zsu.zp.ua/racing/) funded by the MONU was accomplished in 2005 and resulted in the development of the research prototype of the intelligent distributed information retrieval software based on software agents, Semantic Web Services and OWL ontologies for information resource description. The research activities in frame of the UnIT-Net project (http://www.unit-net.org.ua/) funded by the ETF (TEMPUS/TACIS) resulted in the development of the research prototype of the National Infrastructure for the Electronic Data Interchange (IEDI) comprising Semantic Web based

Fig. 1. The distribution of the research groups focusing on the Semantic Web research in Ukraine.

[1] http://www.cs.jyu.fi/ai/OntoGroup/IASW-2005/index.html

components and tools for processing semantic queries to the grid of the information resources of Ukrainian Universities. UnIT-Net project has been run in cooperation with the four Ukrainian teams from Kharkiv Karazin University, Kherson State University, Zaporizhzhia Humanitarian University, and the MONU. This collaboration also involved the active participation of the teams from the University of Nice - Sofia Antipolis and the Glasgow Caledonian University. One of the results of this activity was the establishment of the IEDI Working Group at the National scale. The research and development of the ISRG team in the industrial PSI project (http://ermolayev.com/ISRG/ISRG-projects-PSI.htm) funded by Cadence Design Systems, GmbH in 2005 focused on the development of the PSI family of OWL ontologies which are used in modeling and simulation of Dynamic Engineering Design Processes (DEDP). In PSI the ISRG collaborates with Cadence Design System, GmbH, Saint-Petersburg Institute of Informatics of the Russian Academy of Sciences, Czech Technical University, Certicon Corp.

The Semantic Web related research of the Ternopil node is led by Prof. Anatoliy Sachenko and Dr. Roman Pasichnyk from the Institute of Computer Information Technologies, Ternopil National Academy of Economy[1]. They cooperate with the researchers from the State University of New York (USA). Their focus in 2005 was in the study of Web Ontologies. The related ongoing research project funded by the Ukrainian Government is the "Development of Knowledge Base Architecture and Knowledge Discovery Methods for Intelligent Information Systems in Economy". The results will be used as the practical testing ground for the development of business oriented Web based knowledge resources, using recently developed ontology languages like OWL (http://web.njit.edu/~kh8/project/).

2. Contributions of Ukrainian Semantic Web Researchers

The main objective of the IOG is to contribute to the faster adoption of the Semantic Web and the related technologies to local and global industries. It implies the research and development aimed to architect a Global Understanding Environment (GUN) as the next generation of Web-based platforms by making heterogeneous industrial resources (files, documents, services, devices, business processes, systems, organizations, human experts, etc.) web-accessible, proactive and cooperative in a sense that they will be able to perform intelligent activities in an automated fashion. This intelligent capabilities comprise behavior planning, the monitoring and the correction of their own state, communication and negotiation with their peers as prescribed by their roles in a business process, utilization of the remote experts, Semantic Web Services, software agents, and various Web applications [4, 5]. Attacking this challenge in 2005 the IOG contributed by the development of the General Proactivity Framework (GPF). GPF is a means to describe the individual behaviors of the "smart" resources. It comprises the Resource Goal/Behavior Description Framework (RgbDF), the corresponding RgbDF-based domain ontology, the RgbDF engine and the family of the "Semantic Behavior Adapters" to transform the data from the variety of the existing behavior specification languages and formats to RgbDF and bakkwards [2, 3].

The focus of the ISRG is the synergy of the Semantic Web, the Semantic Web Services, agent-based approaches and grids. Group's contributions in 2005 were in the development, the adoption, the application of the Semantic Web frameworks and technologies in Distributed Information Retrieval and Engineering Design Process Management.

The main accomplishment of the ISRG in the agent-based information retrieval was the development of the formal framework to shape out agent negotiation strategies in meaning negotiations [6]. The framework is based on the Type Theory and uses presuppositions and propositional substitutions as the formal means to concede on the meaning of concepts. Several similarity measures are used to measure how close a concept in a certain context in the domain theory of the one party is close to the concept in the domain theory of the other party. The framework also employs the degree of the reputation of a party to adjust the ratio of its concession.

The activities of the group in the IEDI WG resulted in the prototyping of the intelligent mediator for querying distributed heterogeneous information resources annotated with OWL ontologies. The software is based on the mediator-wrapper architecture with the centralized mediator exploiting the common Mediator Domain Ontology (MDO). Information resource ontologies are mapped to the MDO in a semi-automatic way. However the queries in the terms of the MDO are processed totally automatically. Query processing comprises the steps of query formulation, query decomposition, partial query processing by resource wrappers, query results delivery. IEDI resource wrappers are implemented as the Web Services enhanced by semantic processing capabilities. The prototype also comprises the user-friendly graphical query formulation engine which uses the hyperbolic interface for ontology representation [7].
In DEDP managment the activities of the group were focused on the development of the family of OWL ontologies as the description suite for representing different facets of an engineering design process in its dynamics [8]. PSI modeling approach

[2] http://www.tanet.edu.te.ua/index_en.php

assumes that a design process is a weakly defined problem solving workflow comprising a Design Artifact (the object and the goal), an Actor (the subject) who may enter or leave a Design Team, a Software Tool (a means), an Activity and a Task (the configuration of actions).

3. Government Actions in Support of the Semantic Web Research Programs

The government of Ukraine does not distinguish the Semantic Web research among the other important fields. There is not a special subprogram or a special line for funding the Semantic Web related activities in the State Research Funding Program for 2004-2006. However, some projects were funded by the sub-program for the 'Novel Computer-based Means and Technologies for the Informatisation of the Society'.

The main funding sources for the currently performed projects of the Ukrainian Semantic Web researchers are the European frameworks and the industrial and the governmental sponsors abroad. It should be mentioned that the Ukrainian companies are still passive in initiating and conducting the R&D related to the Semantic Web. Some actions of the MONU and the leading research centers have been undertaken in 2005 to wake the industrial partners up.

At the fall of the 2005 the MONU hold the meeting of its top officials and several National experts in the Semantic Web area. The objective was to analyze the applicability of the SW Technologies to the management of Ukrainian Universities. The meeting resulted in the launch of the new initiative - the development of the National Semantic Portal for the Network of all Ukrainian Universities and Ministry of Education and Science. At the moment the project is funded by the MONU. The Vice-Minister Mikhailo Stepko supervises the project on behalf of the MONU. Kharkov National University of Radioelectronics is the main contractor with Prof. Vagan Terziyan as Principal Scientist and Prof., Vice-Rector Natalie Lesna as the project manager.

In 2005 the financial and planning division of the MONU also took part as the use case partner in the UnIT-Net project. The team led by Svitlana Danilenko provided their domain expertise for the design of the Information Resource ontologies for the IEDI.

4. Semantic Web Education in Ukraine

The Department of AI at KNURE is the first and only one in Ukraine offering a full 4+1 Master Degree Program in the area of the Semantic Web under the umbrella of Intelligent Decision Support Systems curriculum. The Semantic Web related part of the curriculum was developed and introduced in cooperation with the Artificial Intelligence Department of the Vrije University of Amsterdam and in line with the IEEE/ACM Computing Curricula recommendations. In particular, Semantic Web studies comprise the courses on 'Knowledge and Ontology Engineering', 'The Semantic Web', 'The Semantic Web Services', 'Intelligent Agents and Applications', 'Internet Technologies'.

The critically important part of the studies is the System Development Project organized in cooperation with the local and the European industrial and research partners. The Master Program also includes 1 to 4 semesters of studies abroad at one of the KNURE's partner - universities in Amsterdam, Jyvaskyla, Vaasa, Cergy (France), or Houston. Students are strongly encouraged and logistically supported to participate in European Summer Schools whenever the subjects are related to the Semantic Web, Ontologies, or Intelligent Agents. In addition to the Master Program AI Department offers the PhD studies in the Semantic Web and Ontologies. The first PhD research on Educational Ontologies was accomplished and publicly defended at the fall of 2005.

In 2005 AI Department staff members also gave the Semantic Web related courses in the Netherlands and in Finland (http://www.cs.jyu.fi/ai/vagan/courses.html).

The department of IT at Zaporozhye National University also offers several courses as the part of the Master curricula in Applied Mathematics and Informatics. In 2005 the following Semantic Web related courses were given by the members if ISRG: 'Knowledge Bases and Expert Systems', 'Ontology Engineering'. The course on 'Agent Technologies on the Semantic Web (http://ermolayev.com/ASW/)' was offered as the part of the program of the 15th Jyvaskyla Summer School. The members of ISRG also give tutorials at the international events. In 2005 a tutorial [9] has been taught at the 24th International Conference on Conceptual Modeling.

Internet Reference Points

[in this section provide urls of key SW reference points in [country]. Use Title, URL, Last Access date e.g.

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6. SmartResource project: http://www.cs.jyu.fi/ai/OntoGroup/SmartResource_details.htm [13.03.2006]
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