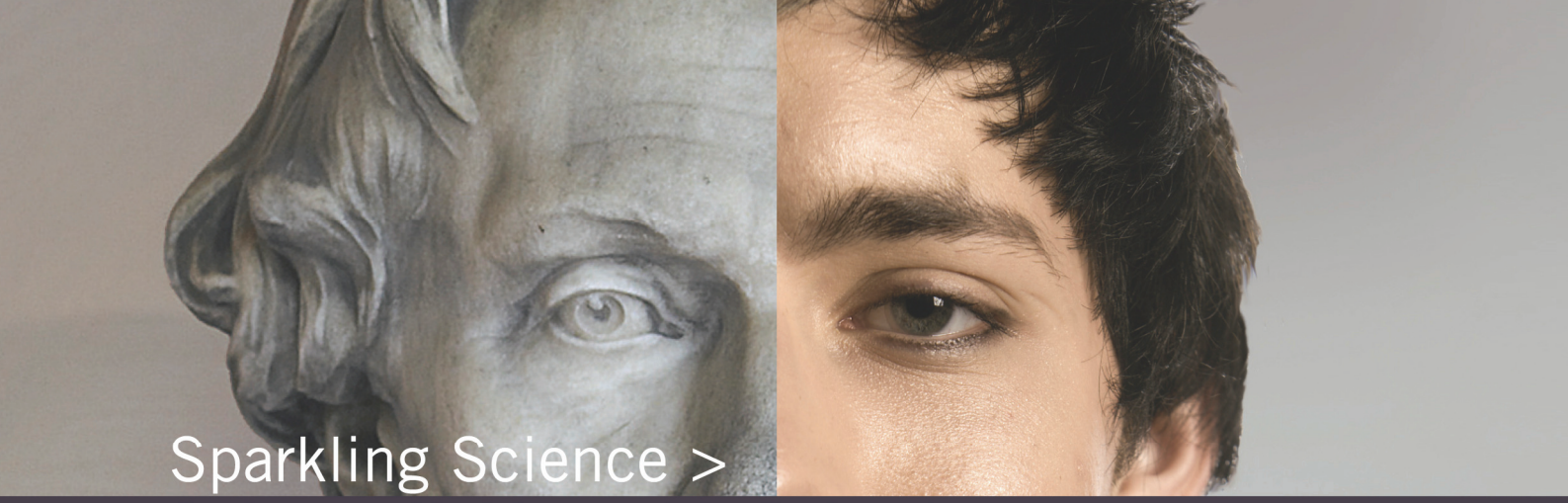


Sparkling Science >

Science linking with School
School linking with Science

Project Review 22.08.2011

FUNSET Science
Future Network-based Semantic Technologies

LEADING INSTITUTION
Vienna University of Technology,
Automation and Control Institute
DI Dr. Munir Merdan, merdan@acin.tuwien.ac.at
DI Mag. Gottfried Koppensteiner, koppensteiner@tgm.ac.at

PARTNER FROM ECONOMY AND SOCIETY
COPA-DATA GmbH, Vienna

SCHOOL INVOLVED
Technologisches Gewerbemuseum, Vienna

BMWF

www.bmwf.gv.at

Austrian Federal Ministry of
Science and Research

Sparkling Science >
Science linking with School
School linking with Science

FUNSET Science

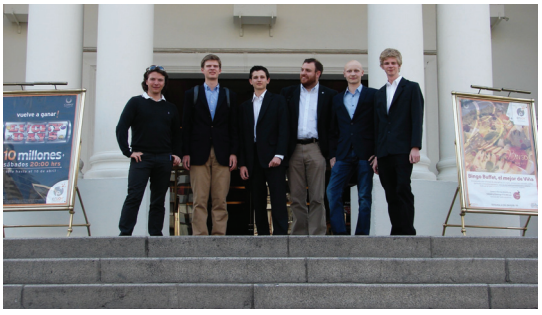
Future Network-Based Semantic Technologies

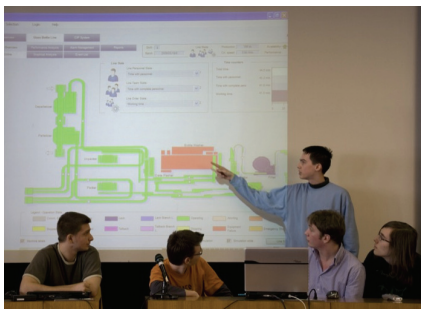
Current markets are operating in turbulent and dynamic environments being influenced with permanent requirements for higher quality and lower price of the products and services. Such circumstances as well as rapid technological achievements force manufacturing companies to emerge in a new way of organizational and production paradigms, such as virtual enterprises. A virtual enterprise (VE) is seen as an integrated network of regular companies that join their core services and resources in order to respond to unexpected business opportunities collaborating on an ad hoc basis. In this context, the information and knowledge exchange between partners plays a critical role for the success of such networks.

In this project, the semantic and software agent technologies were applied to answer on these requirements. On the one side, intelligent agents offer a convenient way of modeling processes and systems that are distributed over space and time, making the control of the system decentralized, thereby reducing the complexity, increasing flexibility and enhancing fault tolerance. On the other side, ontologies have been developed and investigated for quite a while in artificial intelligence and natural language processing to facilitate knowledge sharing and reuse.

An ontology-based multi-agent architecture was developed for the knowledge exchange and process control in virtual enterprises. The system architecture is based on a heterarchical structure, in which every agent can influence any other agent's behaviour and where each agent manages its own activities based on its local state or the information received from other agents. A software agent can be used to represent functions such as order, task etc. or a physical entity such as machine, human, product etc.

Furthermore, a persistent ontology was developed to enable and support a semantic interoperability between heterogeneous inter- as well as cross company levels. A general accepted ontology allows an easier integration of the underlined domain concepts, ensuring at the same time the understanding of exchanged knowledge during the inter-agent communication. The exploitation of semantics and ontologies in the area of agent-based industrial systems has become the hot topic in the last few years due to the success and good promotion of the semantic web, which is the World Wide Web extension where the information is given well-defined meaning, to enable better communication between computers and people.





Project Review 22.08.2011, DI Dr. Munir Merdan, merdan@acin.tuwien.ac.at

In order to test the approach, four different companies were selected with related products and services. The major aspect here was that associated ontologies cover different concepts and workflows. Each concept was separately analyzed and developed by other student groups:

- MASME-Factory: an agent based batch processing factory for liquids
- WareLoXX-warehouse: a warehouse system for the commitment of orders
- Bottling Plant: a bottling plant for the filling of bottles combined with LiStoSys-Ontology

The forth case, which represents the company responsible for negotiation between these three companies, is used to integrate the entire system in one virtual enterprise. The functioning FUNSET-project was officially presented on the FUNSET Sience Closing Conference at the Technologisches Gewerbemuseum in Vienna (TGM) on 12th May 2010.

More than 30 students worked extensively on this project within two years. The results of the project were presented on the following conferences:

- G. Koppensteiner, M. Merdan, W. Lepuschitz, E. List, L. Vittori: "Ontology-Oriented Framework for Virtual Enterprises"; lecture: International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management, Funchal, Madeira, Portugal; 06.10.2009 - 08.10.2009; in: "IC3K 2009", (2009), 8 S.
- G. Koppensteiner, M. Merdan, W. Lepuschitz, C. Reinprecht, R. Riemer, S. Strobl: "A Decision Support Algorithm for Ontology-Based Negotiation Agents within Virtual Enterprises"; lecture: Future Information Technology and Management Engineering FITME 2009, Sanya, China; 13.12.2009 - 14.12.2009; in: "Future Information Technology and Management Engineering FITME 2009", (2009), ISBN: 978-0-7695-3880-8; S. 546 - 551.
- W. Lepuschitz, G. Koppensteiner, M. Barta, T. Nguyen, C. Reinprecht: "Implementation of Automation Agents for Batch Process Automation"; lecture: IEEE-ICIT 2010 International Conference on Industrial Technology, Vina del Mar, Chile; 14.03.2010 - 17.03.2010; in: "USB Proceedings ICIT 2010", (2010), ISBN: 978-1-4244-5697-0; 6 S.

Furthermore, an entry was published in the conference proceedings

- G. Koppensteiner, M. Merdan, I. Hegny, W. Lepuschitz, S. Auer, B. Grössing: "Deployment of an ontology-based agent architecture on a controller"; in: "Proceedings INDIN 2010 - 8th IEEE International Conference on Industrial Informatics", IEEE Conference Proceedings, 2010, ISBN: 978-1-4244-7299-4, 6 pages.

as well as in the INTECH book “Modeling, Control, Programming, Simulations and Applications”

- G. Koppensteiner, M. Merdan, W. Lepuschitz, T Moser, C. Reinprecht: "Multi Agent Systems combined with Semantic Technologies for Automated Negotiation in Virtual Enterprises"; in: "Modeling, Control, Programming, Simulations and Applications", INTECH, 2011, ISBN: 978-953-307-174-9, 221 - 240.

Sparkling Science >
Science linking with School
School linking with Science

OeAD-GmbH

www.bmwf.gv.at

Austrian Federal Ministry of
Science and Research