# www.AgentEnterprise.net – a MMAS-based Web-Portal for Planning and Control of Complex Manufacturing Supply Chains managed by ASCML – the Agent Society Configurator Manager and Launcher

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## 1. www.AgentEnterprise.net

### 1.1. Contributing Projects

This work was funded by the German Research Council as part of the priority research program no. 1083 “Intelligent Agents in Real-World Business Applications” (see http://www.realagents.org for further details). The following projects and the projects in Section 2.1 are part the aforementioned program:

**DispoWeb** (Universität Frankfurt, Germany)
http://www.dispoweb.de/

**ControMAS** (Universität Karlsruhe (TH), Germany)
http://www.ipd.uni-karlsruhe.de/ControMAS/

**IntaPS** (Universität Bremen and Universität Hannover, Germany)
http://www.intaps.org/

**ATT/SCC** (Universität Erlangen-Nürnberg, Germany)
http://www.wi2.uni-erlangen.de/research/ATT/index-e.html

### 1.2. Summary

The working groups manufacturing logistics and agent technology of the German priority research program SPP 1083 "Intelligent Agents in Real-World Business Applications" jointly developed an open testbed for agent technology designed to be applied to complex manufacturing supply chains, called "*Agent.Enterprise*". Aim of the testbed is to allow for comparative experiments of different research approaches and industrially applied solutions within a common scenario. At the AAMAS NetDemo we present the current prototypical implementation of the testbed and report on our experiences in building large distributed simulations for multi-multi-agent systems (MMAS). The MMAS incorporates three types of MAS: one for supply-chain-wide planning of orders (SCP-role), one specialized for intra-organizational production planning and scheduling (supplier-role) and one for supply chain tracking (SCT-role) that is responsible for supply chain event management. The application scenario is a multi-level industrial supply chain for production of agricultural machines. Nevertheless, the basic concepts and underlying architecture of the testbed prototype may be applied to other similar scenarios of complex supply chains in the manufacturing domain. Each enterprise in the supply chain is represented by one SCP-Agent, one gateway agent to the internal production planning MAS playing the supplier-role and one agent of the SCT-MAS. Interaction among all MAS is visualized within a portal-website that provides the opportunity to initiate new experiments (e.g. placement of new orders) and reset the simulation. Each participating MAS is visualized separately in the context of the whole supply chain. The technical management of the MMAS is done using ASCML (see Section 2). The demonstration of Agent.Enterprise starts with supply-chain-wide planning activities that integrate local production planning. After an

initial schedule of orders is identified, this plan is executed. During fulfillment disruptive events are encountered at different levels of the supply chain and are detected by the SCT-MAS. As the disruptive events delay production, replanning activities are triggered by the SCT-Agents that are conducted by the enterprise-specific instances of the SCP-MAS. Only if local replanning is not successful a complete replanning on supply chain level is initiated. The references provide further information on the Agent.Enterprise MMAS [2] and the underlying development process [3].

## 2. ASCML – the Agent Software Configurator Manager and Launcher

### 2.1. Contributors

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### 2.2. Summary

Support for the deployment of agent applications is currently very poor, compared to areas such as distributed object systems, where systematical guidelines and mechanisms for the involved activities have been developed. Multi-agent systems, composed of autonomous proactively (inter-)acting entities, differ considerably from distributed object systems, therefore appropriate deployment techniques have to be newly invented or adapted. The vision of the ASCML (Agent Society Configuration Manager and Launcher) project is to define agent applications using high-level specifications declaring what system properties need to be fulfilled for the application to work properly. E.g. one could demand certain services and agent roles to be available, whereby the deployment environment has the task to interpret and supervise these constraints and has to start agent instances accordingly. The ASCML project has developed a platform independent reference model for a new deployment infrastructure. As part of the reference model a generic meta-model for the specification of agent applications is introduced, which consists of one layer for the definition of agent types and another one for the ordered composition of agent instances belonging to a certain application scenario. To prove the applicability of the proposed model an ASCML tool is implemented as FIPA-compliant agent for the JADE platform.

At the AAMAS NetDemo we present the current development version of the ASCML considering as example distributed agent-based applications from hospital and manufacturing logistics, and report on our experiences in building large distributed simulations for MMAS. In the area of manufacturing logistics we present the supply chain scenario described in Section 1. In the area of hospital logistics a scheduler for hospital theatres is presented. Additional scenarios are available to demonstrate the key functionalities of the ASCML, e.g. the deployment and management of distributed agent applications, distributed measurement of the coordination traffic of an agent society, distributed sniffing of ACL messages, etc.

## References

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[2] D. Frey, T. Stockheim, P.-O. Woelk, and R. Zimmermann. Integrated multi-agent-based supply chain management. In *WETICE '03: Proceedings of the Twelfth International Workshop on Enabling Technologies*, pages 24–29, Washington, DC, USA, 2003. IEEE Computer Society.

[3] T. Stockheim, J. Nimis, T. Scholz, and M. Stehli. How to build a multi-multi-agent system: The agent.enterprise approach. In *ICEIS (4)*, pages 364–371, 2004.