# STSM SCIENTIFIC REPORT

## 1 Reference

**Short Term Scientific Mission, COST Action IC0801**
**Beneficiary:** Robrecht Haesevoets, Katholieke Universiteit Leuven
**Host:** Frank Dignum, Universiteit Utrecht
**Period:** 15th January to 31st January 2010
**Place:** Delft/Utrecht (The Netherlands)
**Reference code:** 200907
**STSM title:** Middleware Supported Open Negotiation Protocols

## 2 Purpose of the visit

Within the research track on agent organizations, our research group has been working on the MACODO approach [4, 3]. MACODO (Middleware Architecture for Context-Driven Dynamic Organizations) consists of two main parts, a formal organization model and a software architecture for an organization middleware. The organization model provides modeling concepts for dynamic agent organizations that automatically evolve according to a dynamic context. The organization middleware provides run-time support to enforce this model and separate the concern of managing dynamic agent organizations, from the agent themselves.

The host institute has a well known track record on modeling agent organization. Their approach is called OperA (Organizations per Agents) [1]. OperA provides an extensive theoretical framework for modeling agent organizations. The OperA approach provides support, a formal model, methodological guidelines and the OperettA tool [2] for modeling the different dimensions of agent organizations, including normative structures, and interaction structures and patterns.

Because our current MACODO model is lacking good support and concepts for interactions and behavior within organization, the visit was an interesting opportunity to explore the support offered by OperA and starting point for further extension our MACODO model.

## 3 Description of the work carried out during the visit

During the first week of the visit, an in depth study of OperA was performed, together with a number of discussions with the original authors, to explore the possibilities

offered by OperA.

In the second week, a scenario from the MACODO application domain (supply chain management) was used a case study and modeled using the OperettA tool, to further explore the support offered by OperA, focusing on interactions and behavior within organizations. In this scenario a 4PL (4th party logistic provider) delegates a transport task to a number of 3PLs (3rd party logistic providers). Subsequent problems, which can dynamically occur, such as delays, require a set of rescheduling activities, including interactions and negotiations among the different 3PLs and 4PL.

The results of the case study were then used for discussing the support offered both by OperA as well as the OperettA tool in terms of expressibility, support for dynamics and possible middleware support.

# 4 Description of the main results obtained

Figure 1 and 2 show some examples of models created for the case study. During the case study and the subsequent discussions a number of observations were made. On the one hand feedback was provided to the authors of OperA and the developers of the OperettA tool, such as support for modular interactions structures and generating individual agent perspectives from a global interaction structures, which is currently lacking in OperettA. An other observation was that OperA model might not be the perfect match to model typical supply chain flows that can dynamically change. This related to a known issue, dealing with the balance between supporting adaptation at run-time of the organization models and the level of detail in the predefined organization models. The case study has also been useful as a basis for further extensions of the MACODO model, such as landmark patterns and normative structures to restrain the behavior in agent organizations.

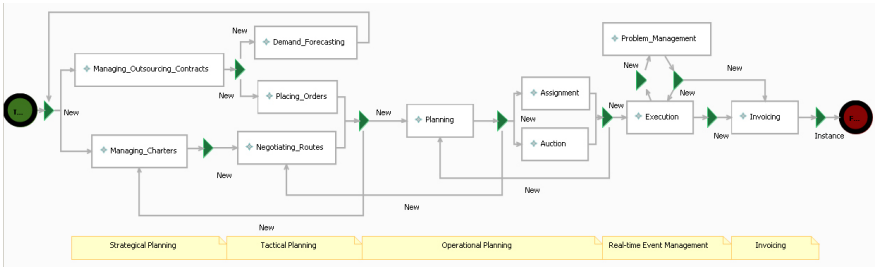


Figure 1: An interaction structure representing the complete flow in a supply chain.

# 5 Confirmation by the host institute of the successful execution of the mission

Due to the change of Virginia Dignum from Utrecht to Delft university of technology it was decided that Robrecht would start his visit in Delft. There he successfully studied

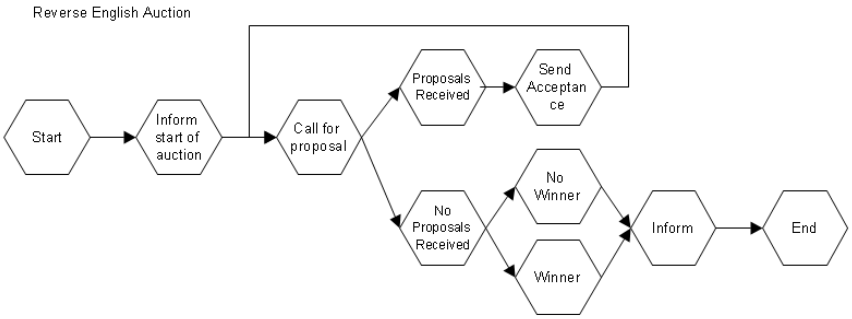


Figure 2: A reverse english auction interaction, used between 4PLs and 3PLs, represented as a landmark pattern.

OperA and tried to apply the framework to a case study. Due to the limited time it was not possible to actually adapt the OperA framework based on some observations. Some continuation in that direction would make the visit even more successful for people developing OperA and the OperettA tool.

# 6 Acknowledgements

I would like to thank COST for making this STSM possible. I also thank Dr. Virginia Dignum, Dr. Frank Dignum and their colleagues for hosting me, answering all my questions and the interesting discussions.

# References

[1] V. Dignum. *A Model for Organizational Interaction: Based on Agents, Founded in Logic*. PhD thesis, Universiteit Utrecht, 2004.

[2] D. Okouya and V. Dignum. OperettA: a prototype tool for the design, analysis and development of multi-agent organizations. In *Proceedings of the 7th international joint conference on Autonomous agents and multiagent systems: demo papers*, pages 1677–1678. International Foundation for Autonomous Agents and Multiagent Systems Richland, SC, 2008.

[3] D. Weyns, R. Haesevoets, and A. Helleboogh. The MACODO Organization Model for Context-Driven Dynamic Agent Organzations. *ACM Transaction on Autonomous and Adaptive Systems*, 2010, `http://www.cs.kuleuven.be/~danny/papers/2010TAAS-model.pdf`.

[4] D. Weyns, R. Haesevoets, A. Helleboogh, T. Holvoet, and W. Joosen. The MACODO Middleware for Context-Driven Dynamic Agent Organzations. *ACM Transaction on Autonomous and Adaptive Systems*, 5(1):3:1–3:29, 2010.