

# *POLAR*: A Graphical, Integrated Development Environment for Agent Organizations

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**Abstract.** There are numerous agent organization models which have been realized, in some form, with an implementation. Some implementations are strictly limited to a specific domain problem while others are more general in nature. Some implementations are simulation oriented while others are developed to address a real-world domain problem with a field implementable system. What most systems lack is a complete development environment where they can be created, tested and evaluated before moving on to a more intensive deployment. *POLAR* is designed and developed to provide a general purpose agent organization development platform.

**Keywords:** Agent Organization, Testbed, Simulation, Implementation

## 1 Introduction

The *POLAR* (*Poly-Organization Lab and Agent Rendering*) software workbench is an initial instance of a multiagent organization integrated development environment (IDE) for the development, simulation and realization of fieldable agent organizations. The motivation and some initial benefits for the development of the *POLAR* tool is discussed in this section.

There are a number of well constructed agent organization models [1] [2] [4] [6]. Looking at the spectrum of implementation, the span of models range from no implementation to complete implementation. But, even with complete implementation, many do not possess the capability to construct, simulate, validate or field valid organizations. Another shortcoming is that some models are focused at only a single task domain. *POLAR* remedies these issues by creating an agent organization development environment allowing complete development of an agent organization and the ability to see all facets of the organization, while under development. *POLAR* will allow agent models application to relevant task domain problems and compare the different agent models under the test domains. Additionally, there is no environment which allows more than one organization model to be used in development so that the resulting systems can be compared to determine the best model for a specific domain problem.

A key difference in other organization development and simulation integrated development environments (IDE) from *POLAR* is the inclusion of organization models. *POLAR* is created with the paramount goal of supporting numerous organization models, which can be expressed either structurally, logically or by some other means such as text. The differing organization models will be used as plug-ins to *POLAR*, so as new models emerge, they can be included. This key feature will allow flexibility in design of actionable organization implementations and compare which is the best organization model to capture and create the proper functionality to solve a real world problem. As each model will have certain inherent strengths, the ability to test those strengths as well as look for weaknesses will improve the model and the instantiation of the model. *POLAR* is written in *Java*, to insure platform independence and portability, and is freely available to all that want to utilize it for creation of their agent organizations or use other published models. *POLAR* is completely graphical in nature and allows for construction of the organization while the organization is rendered for the user to view, resulting in a fieldable organization.

## 2 Capabilities and Innovation

While *POLAR* is an initial development and prototype for a complete agent organization workbench, it has numerous capabilities and innovations. While this section does not represent an introductory list of all future functionality, it does represent a list of crucial functions for an organization development tool.

### 2.1 Facets

A difficulty in development of an agent organization, due to their inherently complexity, is to examine facets to make decisions on the final design. *POLAR* allows the designer to see an organization in terms of a number of views such as the *tree view*, *structural view*, *state view*, *object view*, *relationship view* and *map view*. Each view will show the perspective from a different facet of the organization. There will also be a view of the density. As organizations tend to represent graphs or graph-like structures, the density of the relationships, or *shape*, is important to understand, as this will factor into computation times for transition. All facets will be rendered in tabs contained within *POLAR*'s main interface.

### 2.2 Realization of Task Domain Problems and Simulation

A key element of *POLAR* is the ability to create an instance of an organization, based upon an available model. The first instantiation is likely not the optimal or final version. Once an organization is created, simulation will be used to examine the facets of the organization. Prior to creating the final version of an organization, the ability to simulate will yield reinforcement about design or changes that must be made. The ability to prototype organizations and observe

basic function will allow more robust organizations to be developed. Transitional simulation allows the change of organizations [5] to see the compute times for initial organization and reorganization and determine if the time to compute fits the task domain problem.

Once an organization is instantiated and has been simulated to the point of acceptance, it must be translated into a usable instance, in a real world fieldable scenario. Each organization will be available as output in a series of different options. Each organization can be created as a XML instance, Java-based or logically-based *JESS* object. This is an initial list of organization format outputs.

### 2.3 Future Directions

While *POLAR* is a work-in-process, we must always envision in which directions to proceed to enhance functionality of the tool. While the initial version will include the previously mentioned functionality, future versions will possibly include functionality such as organization model checking, emergent simulation, further models plug-ins and additional outputs. The directions taken will be driven for the greater good of the agents and agent organization community.

## 3 Relation to ESAW

While the name of *ESAW* is "Engineering Societies in the Agents World" [3], *POLAR* fits very well in support of the goals and requirements of the conference. The functionality of *POLAR* lets the user employ different organizational models to develop agent organizations, or societies, and select the best fit solution to solve their specific domain problem.

## References

1. Scott A. DeLoach, Walamitien Oyenon and Eric T. Matson. A Capabilities-Based Model for Artificial Organizations. *Journal of Autonomous Agents and Multiagent Systems*. Volume 16, no. 1, February 2008, pp. 13-56.
2. Dignum, V. A Model for Organizational Interaction: Based on Agents, Founded in Logic. PhD thesis, Utrecht University, 2004.
3. ESAW: 9th International Workshop - Engineering Societies in the Agents World 2008, St. Etienne, France. <http://www.emse.fr/esaw08/>
4. Filipe, Joaquim. A Normative and Intentional Agent Model for Organizational Modeling. Third international Workshop on Engineering Societies in the Agent's World (ESAW '02), Universidad Rey, Juan Carlos, Madrid, Spain (EU), Sept. 16-17, 2002.
5. Hoogendoorn, M., Jonker, C.M., Schut, M.C., and Treur, J., Modeling Centralized Organization of Organizational Change, *Computational and Mathematical Organization Theory*, vol.13, 2007, pp.147-184.
6. Jomi Fred Hbner, Jaime Simo Sichman, Olivier Boissier. MOISE+: Towards a Structural, Functional, and Deontic Model for {MAS} Organization, *Proceedings of the First International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS'2002)*, ACM Press, Bologna, Italy, 2002.