

Visualization of a Market-Based Model for Logistics Management in Transportation

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1. Overview of the transportation model

A recent development in multi-agent systems research is their application in the logistics of the transportation sector. Transportation is a challenging application area where, due to strong competition, profit margins are typically low. Furthermore, the current practice of centralized solutions is a bottleneck and does not support the flexibility required for incidence management or exploiting new and profitable opportunities. The multi-agent system paradigm can overcome these challenges and offer new opportunities for profit. In our research, this is achieved by developing robust, distributed, market mechanisms.

In recent research ([1, 2]), we have proposed a model with online, decentralized auctions, where agents bid for cargo to increase profits by exploiting new transportation opportunities that appear in the course of a day. In this context, we studied the effect of bidding strategies that are novel for such a large scale settings (e.g. allowing *decommitment* of previously won loads in favour of new, more profitable opportunities). The fundamental research on which this model is based and results from performed simulations are presented in [2]. Based on this fundamental model, a software tool was built to allow us to visualize the simulations, in the form of a Java applet. The demonstration paper for this software tool was originally presented as [1]. Due to space constraints, we cannot describe all the details of our simulation here, and the interested reader is asked to consult [1] for details.

2. The visualization applet

Our visualization is comprised of several panels. The main panel presents the structure of the world (i.e. the grid or the road network graph). Two side panels are used to display information about the current truck or depot selected and general information about the world. The visualization can run in two modes: static (in which the user can manually browse through the turns in a day) and dynamic, in which the appearance of new loads and movements of trucks are shown dynamically evolving during the course of a day.

The most relevant elements to visualize in such a simulation are the routes the trucks take during the day, since this can give an idea of the planning involved. There are 2 types of routes that may be visualized:

- *Actual routes* taken by the trucks (here the routes taken by individual trucks or by trucks owned by different companies may be highlighted).

- *Planned routes*. Viewing the evolution of the planned paths, as new loads appear at different time points, gives an insight of the complexity of planning algorithms used. The planned routes for each truck may change dynamically during the day, as plans are continuously expanded to cover the pick-up/delivery of loads newly won in the online auctions.

The objectives we pursued in building our visualization are to:

- Present all information on a single graphical interface
- Provide the user with the ability to easily navigate through the simulation, with complete information and intermediate results.
- The information given should be palatable: it can be understood without delving in the underlying complex semantics of the model.

A Power Point presentation (in the form of a story board), which contains screen shoots of this software is available at [3].

References

- [1] 't Hoen, P.J., Redekar, G., Robu, V., La Poutré, J. A. "Simulation and Visualisation of a Market-Based Model for Logistics Management in Transportation", *Proceedings of AAMAS 2004*, ACM Press, pp. 1218-1219
- [2] Hoen, P.J. t', La Poutré, J. A. "A Decommittment Strategy in a Competitive Multi-Agent Transportation Setting", *Agent-Mediated Electronic Commerce*, 2003. Also published as LNCS 3048, Springer-Verlag, 2004.
- [3] http://homepages.cwi.nl/~robu/AAMAS_presentation.ppt