

## **RedAgent: a supply-chain management agent**

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The Trading Agent Competition's Supply-Chain Management (TAC SCM) scenario is a simulation of a simple supply chain distributed across the internet. Autonomous agents designed by different groups act as manufacturers which compete to obtain materials from a fixed pool of suppliers at the lowest price possible, and to maximize their profit selling to a common pool of customers. From an individual agent's perspective this is a highly uncertain environment in which actions must be taken continuously to solve a complex optimization problem based on incomplete information.

RedAgent-2003, which I designed with Felix-Olivier Duguay last summer, won the first competition. The main idea was to use simulated internal markets to allocate the limited resources available (production capacity, and successfully obtained supplies). The exchange prices in the internal markets could be used as valuations for the various supplies needed, and for the produced finished units, since they condensed information about the strong complementarities between the resources as well as procurement and other costs. These valuations were then used to make procurement and pricing decisions.

RedAgent-2004 extends the market mechanism used internally to attempt to overcome limitations of the old agent's design. It also introduces new methods for the prediction of the external markets (customer and supplier interactions) based on Kalman filters and machine learning.

Essentially, RedAgent provides a framework for different internal agents to exchange goods (and valuations, implicitly) in auctions. The internal agents are directly responsible for taking all actions in the environment, hence the decision process is inherently decentralized.

The auction mechanism used is crucial, as it must ensure an efficient allocation of resources while at the same time ensuring good coordination between the agents dealing with customers and those dealing with suppliers. Since few, if any, theoretical results from auction theory apply in such repeated auctions, the bidding behavior of the internal agents also plays a crucial role in the overall efficiency.

I will present a brief overview of the TAC SCM simulation and of RedAgent's architecture. Then, I will explain in some detail the function of certain

internal agents used, and the auction mechanism used for the internal markets. Finally, I will address some issues with our agent and the competition in general.

Francois Plamondon has worked on the specific problem of using machine learning for predicting the revenue generated by selling a given quantity of finished products at a given time. He will discuss this important issue in depth.