Auction-based Electronic Markets for Human and Software Traders

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Abstract

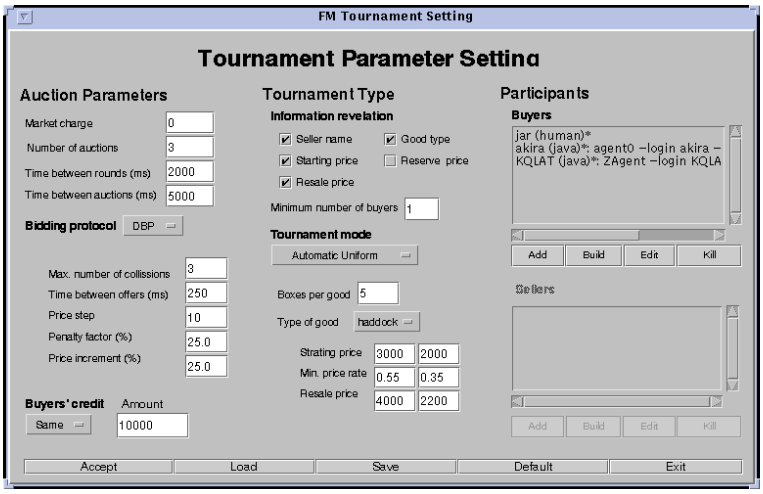
Auction-based e-commerce is an increasingly interesting domain for developing trading agents competing in multi-agent electronic markets. We present a framework for defining trading scenarios based on fish market auctions. In these scenarios, trading (buyer and seller) heterogeneous (human and software) agents of arbitrary complexity participate in e-auctions under a collection of standardized market conditions and are evaluated against their actual market performance. Such competitive situations constitute convenient problem domains in which to study issues related with agent architectures in general and agent-based trading strategies in particular. The proposed framework, FM, constitutes a test-bed for trading agents in auction tournament environments.

1 Introduction

Internet is spawning many new markets. In this sense, we observe that the proliferation of on-line auctions in the Internet—such as Auctionline (http://www.auctionline.com), Onsale (http://www.onsale.com), InterAUCTION (http://www.interauction.com), eBay (http://-www.eBay.com), and many others — has established auctioning as a main-stream form of electronic commerce. Thus, agent-mediated auctions appear as a convenient mechanism for automated trading, due not only to the simplicity of their conventions for interaction when multi-party negotiations are involved, but also to the fact that on-line auctions may successfully reduce storage, delivery or clearing house costs in many markets. This popularity has spawned research and development in agent-mediated auction houses as well as in trading agents endowed with intelligent auction strategies.

The matter of trading within an auction house appears to be numbingly complex, because of the numerous variables coming into play. The actual conditions for deliberation are not only constantly changing and highly uncertain—new goods become available, buyers come and leave, prices keep on changing; no one really knows for sure what utility functions other agents have, nor what profits might be accrued — but on top of all that, deliberations are significantly time-bounded. Hence there is the intricate matter of providing agent developers with some support to help them face the arduous task of designing, building, and tuning their trading agents before letting them loose in wildly competitive markets.

The FishMarket project[7] conducted at the Artificial Intelligence Research Institute (IIIA-CSIC) attempts to contribute in that direction by developing FM, an agent-mediated electronic auction house which has been evolved into a test-bed for electronic auction markets. The resulting framework, FM[1], constitutes an example of an agent-mediated electronic institution in the sense proposed in [5]. Conceived and implemented as an extension of FM96.5[3] (a



FM Tournament Setting

Tournament Parameter Settina

Auction Parameters

Market charge: 0
Number of auctions: 3
Time between rounds (ms): 2000
Time between auctions (ms): 5000
Bidding protocol: DBP
Max. number of collissions: 3
Time between offers (ms): 250
Price step: 10
Penalty factor (%): 25.0
Price increment (%): 25.0
Buyers' credit: Same
Amount: 10000

Tournament Type

Information revelation
☑ Seller name ☑ Good type
☑ Starting price □ Reserve price
☑ Resale price

Minimum number of buyers: 1
Tournament mode: Automatic Uniform
Boxes per good: 5
Type of good: haddock
Strating price: 3000 2000
Min. price rate: 0.55 0.35
Resale price: 4000 2200

Participants

Buyers
jar (human)*
akira (java)*: agent0 –login akira –
KQLAT (java)*: ZAgent –login KQLA

Sellers

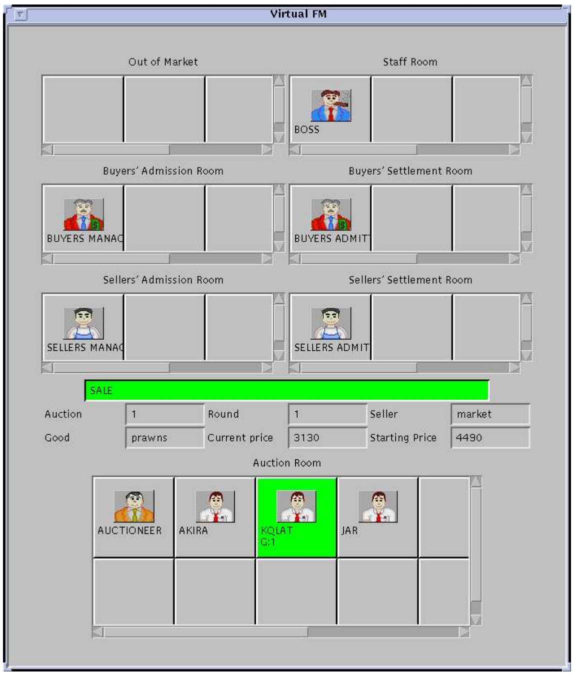
Fig. 1: *Tournament Parameter Settings*

Java-based version of the Fishmarket auction house), FM allows to define trading scenarios based on fish market auctions (Dutch auctions). It provides the framework wherein agent designers can perform *controlled experimentation* in such a way that a multitude of experimental market scenarios—that we regard as *tournament* scenarios due to the competitive nature of the domain— of varying degrees of realism and complexity can be specified, activated, and recorded; and trading (buyer and seller) heterogeneous (human and software) agents compared, tuned and evaluated. We argue that such competitive situations constitute convenient problem domains in which to study issues related with agent architectures in general and auction strategies in particular.

2 System Features

The current version of FM, FM0.9beta[4], is now available and can be downloaded from the FishMarket project web page. Next, we summarize the most salient features of this very first release:

- FM is completely written in Java.
- The customizability of FM allows for the specification, and subsequent activation, of a large variety of market scenarios (see Figure 1): from simple toy scenarios to complex real-world scenarios, i.e., from extremely simple market scenarios in which the same auction is repeated over and over till market scenarios that make FM behave like the actual market. This capability of scenario generation allows the repeatability of the experiments (tournaments) to be conducted.
- FM is multi-user. It allows multiple users to spawn their agents in their own machines in order to make these to participate in remote tournaments.
- FM remains architecturally–neutral since no particular agent architecture (or language) is assumed or provided for building trading agents. Alternatively, a library of agent templates written in Java, C, and Lisp accompanies this release in order to assist agent programmers to build their agents. In this way, the programming effort narrows down to developing auction strategies. Importantly, these templates handle the connection of the trading agent to the FM interagents: autonomous software agents which intermediate the communication between the trading agents and the institution, the market,enforcing them to follow the rules of the game[2, 6].



Auction 1 Round 1 Seller market
Good prawns Current price 3130 Starting Price 4490

Fig. 2: *Monitoring Agent GUI*

- A built-in agent builder facility allows for the automatic generation of agents with customizable auction strategies, so that families of agents capable of simulating different trading behaviours can be easily created.

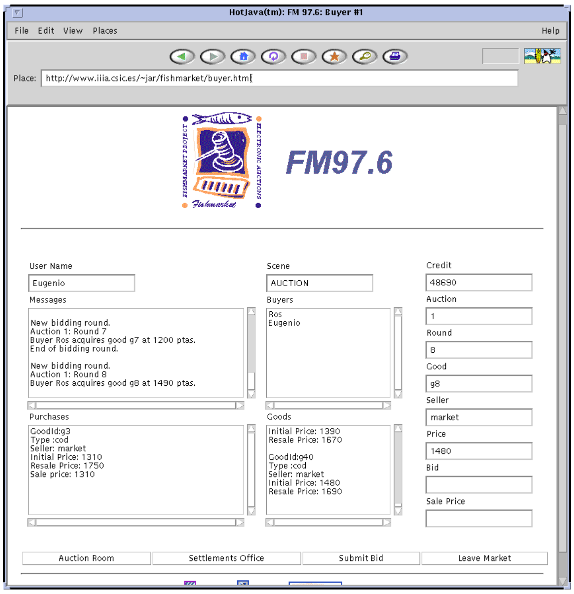
- Auctions can be monitored step-by-step thanks to the FM Monitoring Agent shown in Figure 2. This keeps track of every single event taking place during a tournament in order to obtain a visual, global representation of the agents' flow from scene to scene within the market as well as the communication flow (what the agents utter and when).

- The FM database stores the information to be used by trading agents to carry out market analysis and auditing.

- FM has been designed to be as user-friendly as possible. Thus, the FM GUI allows the whole interaction between the users and FM to be done through graphical interfaces. For instance, Figure 3 shows the GUI employed by a human buyer to take part in a market session.

3 Future Work

But more importantly, the design and construction of FM has served to prove the usefulness of the use of organizational concepts (such as roles, groups or institutions) for the deployment of complex social structures in multi-agent systems. Thus our future work is to concentrate on the completion of a (both graphical and textual) specification language for a special type of multi-agent systems: electronic institutions. Ideally such a language shall support the automatic generation of electronic institutions as well as some of their participating agents. For instance, such a language would permit to specify an auction house in order to obtain the infrastructure (conversation protocols and interagents in the sense proposed in [2]) required for ensuring a sound multi-agent trading interaction.



Place: http://www.iiia.csic.es/~jar/fishmarket/buyer.html

User Name: Eugenio

Scene: AUCTION

Credit: 48690

Messages:

```
New bidding round.
Auction 1: Round 7
Buyer Ros acquires good g7 at 1200 ptas.
End of bidding round.

New bidding round.
Auction 1: Round 8
Buyer Ros acquires good g8 at 1490 ptas.
```

Buyers:
Ros
Eugenio

Auction: 1

Round: 8

Good: g8

Seller: market

Price: 1480

Bid:

Sale Price:

Purchases:

```
GoodId:g3
Type :cod
Seller: market
Initial Price: 1310
Resale Price: 1750
Sale price: 1310
```

Goods:

```
Initial Price: 1390
Resale Price: 1670

GoodId:g40
Type :cod
Seller: market
Initial Price: 1480
Resale Price: 1690
```

Fig. 3: *Human Buyer Applet*

Acknowledgments

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