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meet2trade: A generic electronic market platform*

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Abstract

Presently, a multiplicity of trading systems provide electronic markets with various market rules to professional and private investors in different sectors. This range only partially reflects the individual requirements dependent on the type of product and the environmental context of the trade. There is need for individual solutions satisfying these specific requirements regarding the tradable product, the trading rules and the services. The development of new electronic markets is challenging, since many factors influence the market outcome and hence the markets success. Software tools are required to systematically support the Market Engineering (ME) process. This paper presents the generic trading platform meet2trade that (i) enables users to individually configure their own electronic market, (ii) realizes innovative trading features such as order types or bundle trading, and (iii) provides support for analyzing electronic markets through an experimental system for game theoretic analysis and an agent-based simulation environment for computational approaches.

Keywords: auction server, CAME (Computer Aided Market Engineering), electronic markets, market platform, market modeling language

1. Introduction

During the last two decades the progress of the information technology has enabled the computerization of exchange leading to the appearance of electronic markets. In electronic markets the market outcome depends on the market participants and their valuations as well as on the market structure that stimulates strategic behavior of the participants. Even small changes in the market micro structure can generate enormous effects on the market outcome. For example, according to [18] the bidding behavior in an English auction with a fixed end differentiates from an English auction with soft end. [21] analyze the design of the third generation spectrum auction in the UK and in Germany: The bidder surplus is lower in the German auction but revenue is higher compared to the UK design. Taking another example of the Federal Communications Commission (FCC) regional narrow-band auction in 1994, where thirty licenses were offered for sale (c.f. [3] and [4]). On ten of the thirty licenses a 40 percent bidding credit was granted and offered to businesses owned by minorities. By subsidizing these designated bidders competition was enhanced and unsubsidized firms were induced to bid higher - the governmental revenues were increased by more than 12%. Since electronic markets have become essential mechanisms within daily business, their study is important in order to design mechanism being efficient for new application domains. Therefore, new innovations and methodologies within the market design are required. Hence, [27] have suggested Market Engineering (ME) for the structured development of electronic markets. ME takes into account economic, technical, and juridical aspects of electronic markets. [17] proposes Computer Aided Market

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Engineering (CAME) to assist ME in four phases as depicted in Figure 1: (i) *Design*, (ii) *Configure*, (iii) *Test*, and (iv) *Trade*.

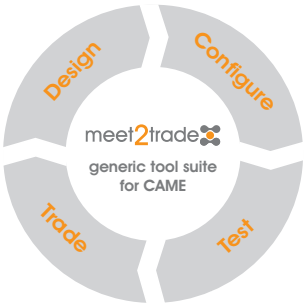

Figure 1: meet2trade supports Computer Aided Market Engineering (CAME)

During the design phase a knowledge database assists to choose the appropriate market structure. In the next step the electronic market is configured considering the chosen design. In order to ensure, that the designed electronic market is sufficient for the intended application, tests are conducted and evaluated in the third phase. These tests are computationally supported by tools. Subsequently, the test results are stored in the knowledge database to be used for future design issues. After sufficient tests, the electronic market is ready for operation.

Individual user requirements have a great impact on the IT-architecture of an electronic market. Since each electronic market has its own characteristic, there is need for individual solutions and need for experimental and computational tools to study the interdependency of market participants and the market structure as well as its impact on the market outcome. These issues imply the need for a generic and flexible electronic platform that supports features that enable users to individually configure their own market with ad hoc availability. However, the lack of knowledge about the impact of market rules or other features on the market outcome demands for software tools to support the evaluation of the individual configured markets.

The generic electronic trading platform meet2trade was developed to meet these requirements. meet2trade provides generic elements in terms of the capability to operate markets with different market rules. Therefore meet2trade provides features such as the Market Modeling Language (MML) for the configuration and testing of electronic markets and tools like the meet2trade Experimental System (MES) and the Agent-based Simulation Environment (AMASE) for the study of the market rules' impact on the strategic behavior of the participants and the market outcome. These tools are described more detailed in Section 4.

The present paper introduces the electronic trading platform meet2trade as a tool suite to support CAME. The next section discusses related work within the area of electronic markets and configuration of electronic markets. Section 3 introduces the electronic trading platform meet2trade giving a brief overview on the platform requirements, its architecture and technologies as well as the application domains. Additional tools of the meet2trade CAME software suite are presented in Section 4. This paper concludes with a summary and a brief outlook (Section 5).

2. Related Work

During the last years the research of electronic markets has focused on generic systems providing various auction or negotiation protocols. The core of meet2trade is an auction server providing a multitude of auction formats. [15] define an auction as “a market institution with an explicit set of rules determining resource allocation and prices on the basis of bids from the market participants.” Consequently, the main task in designing and realizing electronic markets within the platform is to implement a single trading process that supports the set of auction rules. Thus, *standardization* of the trading process is the key to a generic as well as flexible and reusable platform (c.f. [14]). The key idea of standardization is also suggested by [11], who states that all auctions are standardized negotiations. Since the activities of the negotiation determine this process, the standardization requires the identification of these basic activities including rules and parameters ([10]).

The MML follows this idea - rules and components are identified enabling a parametrized approach towards the configuration of the trading process and with this of electronic markets. This approach was also argued by [28, 29]. The model they suggested is based on parameters that are common to multiple types of auctions such as single-sided or double-sided auctions, as well as multi-commodity auctions, e.g. combinatorial auctions. It identifies various independent parameters within three core activities of auctions: (i) bidding rules, (ii) clearing policy, and (iii) information revelation. These activities span a multi-dimensional auction design space into which most of the well known auction mechanisms can be mapped. This concept is implemented in the *Michigan Internet AuctionBot* ([28]), a general platform for price-based negotiation providing a flexible approach of decomposition and parametrization of auction mechanisms.
Another market framework implementing common auction formats that can easily be adapted to new application domains and that allow a dynamic configuration is the Global Electronic Market (GEM) ([19]). The genericity of GEM is based on the decomposition into independent components or more precisely parameters, tailoring distinct aspects of market mechanisms. In particular the heart of the market framework consist of a component called *Order Verifier* determining which orders to accept, the Market Maker component, solving the allocation problem and determining the price, and the *Schedule* component, managing the timing of the orders to be executed. Additional a dynamic configuration of the auction is facilitated by a meta-component called *Builder* for initializing and replacing components during run-time. To generate new markets, new components have to be programmed if this market cannot be combined from previously exisiting components– so the market configuration process requires programming skills in many cases.
Another more theoretical and conceptual approach is suggested by [1]. They name four categories of auction design components: (i) a winner determination component, (ii) a payment determination component, (iii) a component defining the information flow, and (iv) a component defining the bidding language. The authors state that all auctions are precisely variations of these four auction components. For each auction, the rules within the components have to be designed and specified.
The concepts presented above, where only a few examples are taken from the landscape of electronic market design and electronic market platforms, identify core components in the underlying transaction process. They focus on the parameterization of the identified components and the definition of rules within these components. This approach provides the design and configuration of a multiplicity of auction types. All the presented approaches are similar to the key idea of the MML and its prototypical realization within meet2trade. The auction platforms presented, i.e. the AuctionBot and the GEM are comparable with meet2trade in some aspects, e.g. allowing an easy configuration and implementation of various auction types, even during run-time.
The platform meet2trade is an auction-based market platform; components and parameters common to all auction protocols have been identified and realized in the prototype. In contrast to the other presented systems, meet2trade offers all these features in one combined platform. It supports single-sided as well as double-sided auctions and allows for the configuration of new auctions without any programming knowledge through a graphical user interface based on the market modeling language MML.
Besides, meet2trade provides more complex auction protocols, e.g. multi-attribute auctions and multi-item auctions. Additionally meet2trade includes many innovate features and trading concepts, e.g. it allows the combination of auctions to complex market structures or the aggregation of several individual product orders into so called bundle orders. Furthermore functionalities for the evaluation are built right into the platform - an integrated experimental tool and an agent-based simulation tool offer manifold possibilities of conducting research on the created market structures and on innovative trading technologies (c.f. Section 4).

3. The electronic market platform meet2trade

The software suite meet2trade was developed as a tool to conduct research on electronic markets and to prove the realizability of innovative trading concepts introduced in the course of the e-FIT project. This section initially introduces the platform and presents the system's architecture. Thereafter, it is discussed

how to fulfill the specific requirements caused by the operation of multiple market and the market modeling functionality, regarding the generic order format.

3.1 Platform overview

The main concepts of the meet2trade platform are flexibility from a system point of view and configurability from the user perspective. Flexibility in this system context means

1. the ability to host markets from a large variety of domains on the same platform (e.g. financial markets, real estate markets),
2. the automatic adoption of the system to the varying requirements of different domains (e.g. product structure, order structure),
3. the ability to support single-sided auctions as well as double-sided auctions with seamless integration into the system,
4. facilitating fast development and evaluation of new electronic markets, and
5. offering innovative trading concepts like bundle trading or order types.

The goal for the user perspective is to allow for as much configurability and customization of the platform to his individual trading needs as possible. This means the user is able to (i) select (ii) combine, and (iii) configure markets to his individual preferences. Furthermore, he can customize the client presentation by setting up a personal workbench. The least comprehensive step toward providing this flexibility to end-users is maintaining a set of auctions the user can select from (selection). The next step is allowing the user to submit ONE order to a combination of markets at once. This combination ranges from simple sequences of markets the orders passes through to a complex structure with parallel and sequential segments. The most advanced step is to allow the user complete control over the market structure giving him the possibility to design his own market. To facilitate this market configuration process, the description language MML was developed. This language makes it possible to configure an auction by setting the appropriate parameter values. For a more in depth description of the MML see Section 4.1. The innovative trading concepts offered in this system - market configuration and platform flexibility, bundle trading and order types, just to name a few - offer a starting point for a vast area of economic research. The meet2trade system delivers not only the platform to host these concepts, but also provides a tool suite for their examination. The tools offered by meet2trade consist of an agent-based simulation environment (Agent-based Market Simulation Environment; c.f. Section 4.4) and experimental system (meet2trade Experimental System; c.f. Section 4.3).

3.2 System architecture and technologies

The meet2trade suite follows client server architecture with a central server who provides the running platform for all available markets as well as the hosting of all data (e.g. user data, account data, product information, protocol data) and the data preparation. The clients connected to this central server display this data and provide an interface for the submission of orders and bids. The meet2trade system is completely based on Java technology. The server uses the Enterprise Java Beans (EJB) concept while the client is based on pure Java.

The server follows 3-tier architecture (c.f. Figure 2):

The communication layer prepares the data for client presentation, provides for the communication and administrates all connected clients.

The business layer consists of the core market environment called ARTE[1] (Auction Runtime Environment) where all markets are running and all orders are processed.

[1] From the technical point of view ARTE can be considered as a runtime-environment for auctions. It is conceptualized such that any number of auctions can be simultaneously executed in it. Furthermore it manages the life cycle of auctions from their definition and configuration to their determination. ARTE supports various auction types and domains providing auctions multiple services like logging service, timer service, user management service, and communication service.

The database layer encapsulates all database access and therefore provides the logging of all trading data as well as the management of the user and depot data.
The meet2trade server provides functionality for the deployment, configuration and operation of various auction mechanisms, the management of user accounts and depots, the processing of orders and trades, and finally, the logging of all order and trade data.

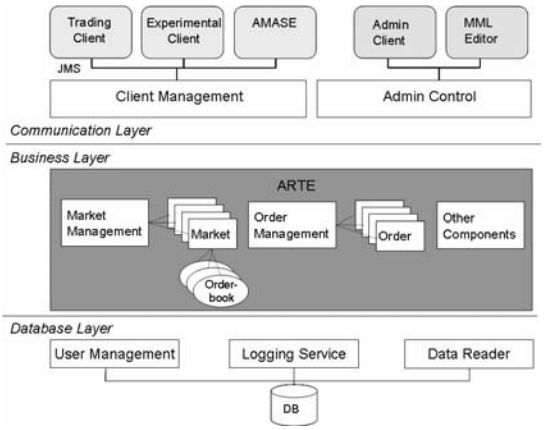

Figure 2: The system architecture of the meet2trade generic trading system

The client-server communication employs the Java Messaging Service (JMS) which provides a reliable queue-based asynchronous means of communication. All data exchanged between client and server is encapsulated in the XML format. The XML format was used because the high degree of configurability and flexibility of the meet2trade system regarding user interface, order structure and domains called for a flexible yet easy to use format. If a user wants to trade on the meet2trade system, he needs to be registered with the system and identify himself by logging in through the client. After the User Management has checked his permission he can submit his offers to buy or sell (orders), which are received and forwarded to the specified market(s) by the Order Management component. From here orders are able to leave and enter markets according to their own specifications without further user interaction, since they are modeled as autonomous objects.
The Market Management administrates all markets running in the system. A market has two different states, active or passive. Orders can only be sent to active markets and are stored within the order book of the market. If two matching orders meet in an order book of a market, a trade can be executed according to the rules of this market. After a successful trade, the user depots which are stored in the database are updated. Thus, the clearing and settlement takes place within the system. During the whole time all events occurring in the system, e.g. the arrival of an order or a successful trade, are written into the database by the Logging Service.

3.3 Multiple markets and domains

One objective while building the trading system was not to limit it to one specific predefined use-case, but to keep it flexible enough to accommodate markets of almost any domain. This requires both, ARTE and the user interface, to adapt to the different market characteristics of different domains. The most important factors distinguishing markets of different domains are the explicit market rules and the characteristics of the products traded on these markets. The first factor, the different trading rules, is addressed by the MML that enables users to configure and to create markets suitable for individual requirements and are discussed in Section 4.1.
Furthermore, a generic order-structure was defined to cope with the second factor – the different product characteristics. The generic order-structure defines a framework that comprises the characteristics of the transaction object. This structure of the order can be changed or redefined dynamically depending on a

change in the environment or due to occurring events. During system runtime this predefined attribute setting is communicated to the client for the adjustment of its interface accordingly. For an in-depth description of this process and the adaptive client confer also to Section 4.2.
Each market instance can only be linked to one product category meaning that in this market only product of one kind, e.g. bonds, can be traded. Thus, the order structure defines what kind of product is traded in one market. For example, in a bicycle market the order structure differs completely from the order structure of a stock market. As the market structure is tightly coupled with the products traded in it, the order structure is set up by the market-designer during the market definition process.
This set-up process involves the definition of product attributes. They are used (i) for the product description and (ii) for the matching[2]. For standard auctions the basic attributes usually are volume and price, for multi-attribute auctions attributes can range from price and volume to quality levels, lead times, etc. Each attribute can be further configured by setting attribute parameters. These parameters include the attribute type (matching or descriptive), the attribute unit and the range of the attribute value.

4. The meet2trade software suite

The meet2trade platform provides functionality to support the steps within CAME. As described earlier, the aim of CAME is to provide users with a toolkit to simplify the development and evaluation of electronic markets. The configuration of electronic markets is supported by the MML that allows the easy configuration of electronic markets. The adaptive client enables the user to immediately use the configured market, since the client GUI automatically adapts to the information pushed by the market server and provides all information necessary for the user in real-time. For evaluation, the platform provides MES to conduct game theoretic experiments and AMASE for simulation purposes.
Apart from meet2trade as a CAME-software, the system has two additional features, innovative order types (c.f. [12]) to facilitate innovative trading and a bundle trading component (c.f. [9]) that allows to deal a package or bundle of several interdependent products. The special components of meet2trade i.e. the MML and the generic client as well as the test-tools AMASE and MES are presented more in detail in the following section.

4.1 Market Modeling Language (MML)

Understanding markets as set of rules and components enables a parameterized approach to market configuration. The MML was developed to describe electronic markets' parameter (c.f. [13]) in order to facilitate the development of electronic auctions.
The meet2trade-markets follow the generic process that was inspired by the Media Reference model introduced by [20] and the Montreal Taxonomy of [23]. The genericity of the transaction process is based on its reusability that means that one and the same basic structure of the process is usable for any auction mechanism within meet2trade. Thus, the generic transaction process is implemented in a domain-independent and flexible manner: The basic process is detached from the application domain, its specific transaction object, and specific behavior of market participants. The generic process is adaptable to different domains and to different trading objects within one domain. These characteristics allow a great flexibility in the design and creation of new auction mechanisms, facilitating an easy way to configure and to implement the process into new domains.
The focus within the platform is not only on the well-known auction mechanisms but also on more complex auction formats and varieties of these. Note, as number of criteria or parameters determining the auction type within meet2trade are manifold, they cannot be listed completely.
meet2trade supports both kind of auction types: single-sided as well as double-sided auctions. The most famous sell-side auction types within the single-sided format are the stereotype of an English auction and the descending auction (Dutch auction) as well as the first-price sealed-bid auction and Vickrey auction.

[2] Matching is the procedure that computes for one order its counterpart order from the opposite side of the market.

Additionally buy-side auction types with a single buyer and multiple sellers such as reverse auctions for procurement or reverse sealed-bid auctions are provided within the platform.
Focusing on the double-sided auctions with m sellers and n buyers the classical auction formats of Continuous Double Auction (CDA) and Call Market are implemented. In the CDA each submitted order will be directly executed as soon as a match is possible; in the Call Market all orders are collected until the execution of the matching.
Moreover, meet2trade supports multi-unit auctions with a generalized uniform pricing rule as well as multi-attribute auctions and combinatorial auctions. Concerning the multi-attribute auctions two forms of the ascending and reverse auction format are realized: (1) orders are matched to maximize revenue of the owner of the orders, (2) orders are matched with the aim of maximizing welfare [8]. In the field of combinatorial auctions a Bundle Trading mechanism, i.e. a double-sided auction mechanism, allowing bids on packages or bundles of items, is integrated in the platform ([9]).
All auction types mentioned above can be configured and combined within the platform meet2trade into complex market structures by parameters integrated into the MML. The configuration is supported by about 100 parameters that have been identified in order to specify the components from a static view and trigger activities and processes from a dynamic view. About 50 parameters of them are used for the configuration of the generic transaction process, e.g. controlling matching and execution of submitted bids or orders, or determining additional aspects like information revelation (how much information to provide to whom), restrictions on the participation (who is allowed to participate), the definition of events, or additional parameters such as bidding credits. The combination of auctions into complex market structures is supported by further 41 parameters. These parameters control the combination of single market mechanisms, either (i) sequentially, (ii) parallel or both, (iii) sequentially and parallel [7]. The *sequential combination* provides a sequence of single market structures, i.e. auctions, whereas in a *parallel combination* single market structures are running simultaneously. Here, the new market structure provides a parallel existence of the single auction mechanisms. The *sequential and parallel combination* allows arranging parallel combined market structures in sequence or sequentially combined market structures parallel with various market structures.
This ability is one of the most significant properties of meet2trade. The combination of the generic process with the parametrization approach makes it a powerful auction configuration platform.

4.2 Adaptive Client

Professional trading systems rely on real-time market data, like order books or market information to allow for immediate reactions to changes in the markets. Since HTML-based web applications cannot display real-time data without additional means or workarounds like Macromedia Flash or embedded Java applets, the client was implemented as a Java application to allow full support of a server push mechanism of this real-time market data. This client concept offers other advantages as well:

- The client is easily configurable by dragging windows around the screen, choosing which windows and kind of information are visible and by distributing windows to different virtual screens. Finally, the current setting can be saved by a mouse click. Subsequently the current configuration is encoded in a XML-representation, and finally, transferred to the server and stored in the database. This allows the client, to display exactly this personalized user interface of the user upon his next login independently of the client the user logs in from, since this data is not stored locally.
- The user interface is built on standard windows components, like drop down menus, resizable, movable windows etc. This allows for higher usability than a HTML-based web application
- The client behavior can be controlled and monitored by the server. This is especially important when conducting experiments with the built in experimental system of the meet2trade platform.

In order to display real time data in the client an intelligent data push mechanism was implemented in the meet2trade server. This mechanism is encapsulated in the Client Management component of the communication layer. Before a client can receive data from the server, it subscribes to this particular data (e.g. a specific order book or the trade history) with the Client Management. The subscription process is handled

automatically by the client that keeps the subscription active as long as a window displaying a particular type of data is open. The subscription is deleted when the last window containing this data is closed.
As aforementioned in Section 3.3 the order attribute settings vary depending on the market. Thus, a mechanism was required for the client to adjust its order entry window according to the auction type and the attributes required by the market. Therefore, each market supplies a XML-based market specific description to the client about its required current parameters. Another challenge was to adopt the client to the diverse auction types. Double-sided Auctions are usually visualized by a 2-sided order book containing sell orders on one side and buy orders on the other side. The sorting of the orders on both sides is configurable with the MML - commonly the 'best' order is on top of the order book. Single-sided auctions on the other hand do not require 2-sided order books, since after an auction has been started; only buy orders in the case of a sell-side auction or only sell orders in the case of a buy-side auction can be submitted. Furthermore the order entry mask of single-sided auctions can vary according to the auction type.
These measures help to achieve the challenge of accommodating on the one hand as many possible kinds of markets on one platform but keeping the system on the other hand easy to use and overlook for the trader.
This generic client is integrated in the experimental system MES which is presented in the next section.

4.3 meet2trade Experimental System (MES)

In order to examine the new concepts of the meet2trade system, e.g. bundle trading or order types, as well as to test and assess new markets which have been designed using the MML, an experimental system has been added to the meet2trade software suite. The main objective is to conduct experiments on the original system instead of having to design, simplify and implement them using standard experimental software like zTree.
This approach on the one hand facilitates experimental studies since the market has to be modeled only once within meet2trade, and on the other hand uses the standard meet2trade-client with the same look-and-feel of the normal trading client instead of a simple graphical user interface of the standard software.
MES provides a graphical client to define and to administrate an experiment. Defining an experiment consists of setting all relevant experiment parameters, such as the allowed users, a questionnaire to examine the users understanding, the configuration of the trading screens, the allowed markets and many more through a simple to use interface. After the experiment definition is finished, the experiment is transferred to the server as an XML- encoded file and can then be started and controlled through the same client application.
Furthermore, Human-Computer experiments can be conducted through integration of AMASE software agents. The application of human-computer experiments opens new ways in the analysis of electronic markets. In the next section AMASE is briefly explained.

4.4 Simulation Environment (AMASE)

Computational approaches are more and more used in economics to study complex systems. Modeling individual strategies within software agents enables economists to study markets, market behavior and its development over time and market microstructure under certain institutional and environmental rules. Agents applied in simulations normally use simple decision rules, learning algorithms, or statistical analysis to adapt their strategies. [24] provides a detailed overview on ACE research and describes studies of market simulations in electricity and financial markets (for examples see also [2], [16], [5], [22], [26]).
[6] has presented requirements for an agent-based simulation environment: agents have to be able (i) to trade on meet2trade (send orders), (ii) to receive information about meet2trade markets, and (iii) to easily exchange messages amongst each other. Another objective is to (iv) distribute agents over different platforms to not limit the amount of agents due to computing resources. Apart from simulations it is intended to provide agent-driven market services to traders. Hence, the (v) reusability of simulation agents is an

other objective. Current simulation tools as RePast[3] do not yet support distributed agents and are limited in communication and mobility features. Therefore, AMASE was developed to enable discrete event market simulations with respect to the named requirements.
AMASE is based on the Java Agent DEvelopment Framework (JADE). The central part in AMASE plays the Simulation Control Agent (SCA) that generates all agents and manages the simulation by sending control messages to the participating agents. JADE agents are equipped with the Simulation Agent Control Behaviour (SACB) which enables agents to receive and reply on simulation control messages. The basic settings such as number of rounds, agent types, or endowment are controlled by the SCA and can be set in the SCA-GUI. The settings are saved in an XML-coded file. AMASE supports the automated repetition of simulations and the definition of a sequence of settings. The simulation specific rules and methods are implemented within the Simulation Management Behaviour (SMB) which is attached to the SCA and on the agent side within the SACB. A more detailed description of AMASE is presented in [6].

5. Conclusion

Today's requirements for electronic markets are manifold, and innovative developments have become an important success factor. The knowledge of interdependencies of the market structure and the market outcome is still constraint to some few effects. To facilitate the evaluation of electronic markets and to provide a high degree of flexibility, we have presented the electronic trading platform meet2trade. This is a generic, flexible trading platform facilitating an easy creation and automation of auction based markets. meet2trade was developed and prototypical implemented as a tool suite to support the CAME process - *Computer Aided Market Engineering*. Additionally, innovative features such as new order types, a bundle trading market, or multi-attribute auctions are integrated in the platform.
The research field ME analyzes all facets of electronic trading from an economic, technical and juridical perspective. It involves the structured, customer-oriented process of designing electronic markets and considers the refinement and the quality assurance of electronic markets within their life cycles. The CAME process focuses on this life cycle; it consists of the four phases (i) *Design*, (ii) *Configure*, (iii) *Test*, and (iv) *Trade*. The design phase requires knowledge about the mechanisms and how these work. A knowledge database assists the market designer to guide and support him during the design phase. Using the *MML* the designed market is created and set-up on the platform meet2trade. The *MML* supports the *configuration* of electronic markets as well as the *combination* of markets. Hence, it is a powerful tool to support the designer in creating auctions ranging from single-sided, to double-sided or even multi-attribute auctions. The created markets are *tested* in simulations and in laboratory experiments under controlled conditions - both, AMASE as well as MES, are linked to the core platform to conduct tests on economic effects. Results of these tests, e.g. impacts on human behavior or market outcome, are used to redesign the trading mechanism and stored within the knowledge database. The tested electronic market is ready for operation on meet2trade according to the predetermined application domain.
So far meet2trade was tested and used in various examples and scenarios. For sports events like the *Tour de France 2004* or the *Olympic Games 2004* auction mechanisms were configured and implemented allowing to trade stocks on occurring events. Studies concerning the financial sector have been conducted, e.g. on innovative order types ([12]) and on bundle trading ([9]). Also within the field of single-sided auction, some first studies are in progress (c.f. [26], [25]).There are many research question actually focused on: information efficiency of financial markets, bidding behavior of market participants in Internet auctions under certain market structural variation, or modeling electricity markets with meet2trade. However, there are many other research question for further studies. Thus, due to its flexibility and reusability the platform has a huge potential for innovative market design in various application domains. The platform meet2trade is a powerful tool facilitating research in the field of electronic ME.

[3] Recursive Porus Agent Simulation Toolkit (RePast): http://repast.sourceforge.net/index.html

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