B2C Electronic Marketplace Based in Intelligent and Mobile Agents

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ABSTRACT

Several architectures were proposed in the literature for the modeling of the interactions between agents. Within the framework of this article, we describe three architectures based on the multi agents design. In these systems, Buyer and Seller agents interact in an environment comparable to an electronic market in order to sell and buy goods. We propose then an electronic architecture of commerce based on intelligent and mobile agents called VEMMA. We present the formal model of this architecture as well as an implementation using the Java language and the RMI technology.

Keywords: *MarketPlace Architecture, Mobile agents, Multi-Agents Systems, Java, RMI, Electronic Business.*

1.0 INTRODUCTION

The distributed character, dynamic about Internet speaks in favor of scalable solutions, opened and flexible, particularly for the development of applications such as the electronic commerce, the virtual companies and the co-operative information systems. The multi agents Systems meet these aims. These systems, characterized by various agents with different capacities, which interact to solve a problem, manage the evolution of the software and allow scalability, re-use of software and open systems [7]. Our interest for the electronic Marketplaces is also presented in the form of direct applications of its mechanisms to the electronic procedures of sales and purchases. We focus our attention mainly in this presentation of a virtual Marketplace based on intelligent agents and particularly the mobile agents. Our aim is to present a formal model of this type of market, while defining a detailed description of the various components and offers strategies of the buyer and salesmen agents. We think of a mechanism which enables us to model the various types of agents belonging to the system as well as the automatic negotiation between agents [10].

2.0 ELECTRONIC COMMERCE INFRASTRUCTURES

Three prototypes of electronic commerce are presented in this article. They are structured around various types of agents. *Kasbah* is a Web site based on a multi agent system where the users create agents to negotiate the purchase and the sale of goods. The second one, *MarketSpace* architecture, describes models of information and interaction for agents in the market. Finally, the prototype *MAGMA* proposes a general structure for a system of virtual market based on agents, which contains all the elements necessary to the installation of an electronic system of commerce. In the following, each architecture is described.

2.1 KASBAH

Kasbah is a Web site where users communicate between them, buy and sell services. This is carried out by creating buyer and salesmen agents that enter the market and interact. The place of the market where commercial space is created to handle any type of agents provides the support of a quite precise protocol. The agents are not sufficiently intelligent although they are completely autonomous, they do not use any technique of training.

Kasbah Agents of Sales and Purchases. Once, an agent is in the commercial space, it negotiates and makes decisions without resorting to the intervention of the user. The latter has a high level control on the agent behavior. When the user creates a new agent of sale for example, it provides for the agent a set of parameters useful in its sale tests. These parameters are:

- *Date wished for the sale of the article*
- *The desired price*
- *The low acceptable price*

The user controls the negotiation strategy by specifying *a weakening function* which is used by the agent to lower the asking price after the expiration of the fixed time. The user has three choices for this function: *linear*, *quadratic* and *cubic*.

2.2 MARKETSPACE

MarketSpace is an infrastructure based on the *agents and interactio*n paradigm. The main characteristic of this architecture lies in the fact that the market is completely open like the Web. Nobody is the owner of this market, it is not the case of the current markets, where all information belongs to the operator of the market (administrator of the system)[3].

The Market Server Architecture. The *MarketSpace* server has three main components:

- *The Kernel* that handles and manages the events which start the activities of the system and the communication with the external world
- *The protocol manager* that handles the agent protocols

- *The agent environment* that implements the runtime environment for the agents.

Two types of events are to be distinguished: the events related to *the time,* which are used by components of the system (objects) and are planned on intervals of regular times and the flow events which announce the arrival data from the outside to the components systems such as the protocol manager.

2.3 MAGMA

MAGMA(Minnesota AGent Marketplace Architecture) is a prototype of a virtual market. Currently MAGMA includes multiple sales agents and an advertising server. The agents are responsible for the purchase and the sale for goods and the negotiation for the prices. To facilitate the communication between agents, the system MAGMA uses a server of relay which maintains all the sockets connections and conveys the messages between the agents based on single names of agents[6]. All the agents in the current version of MAGMA can support SQL by employing JDBC protocol (Java Dated Connectivity Base). This would allow the agents to have an interface with the relational data bases of the existing inventories, as well as the data base of banking and virtual catalogues.

Discussion. The various electronic commerce prototypes presented are structured around various types of agents. These agents are limited in the realization of an adequate strategy of sale and purchase due to the number of limited parameters. More sophisticated agents are necessary, they must have a larger set of parameters for better adjusting the strategy of sale and purchase. The absence of such standard infrastructure for electronic commerce explains the existence of a variety of plate-forms on Internet. Actually, the choice of an infrastructure is enormously related to the type of the commerce interested in.

3.0 THE VEMMA MODEL

The system we propose will make possible the agents to be more intelligent and to use a suitable language facilitating their penetration in several marketplaces. Thus allowing users to build and use agents who follow their specific needs through the network, suggests the use of an advanced language for the communication between agents [11]. VEMMA Architecture includes four types of agents: Buyer agents, Seller agents, broker agents and the administrator agent of the Marketplace. The administrator agent represents the main line operator of the market, and the brokers agents play the role of a bond between the needs for the buyer agents and the offers of the Seller agents. This said, these agents are operators of second degree, they manage a limited set of agents. The agents in VEMMA are able to automate the research centers of products according to the characteristics introduced by the users. In addition, the agents can negotiate the prices and arrive at agreements between salesmen and purchasers in a completely automatic way [5].

3.1 SPECIFICATION OF THE MARKET ENTITIES

The entities used in the virtual Marketplace VEMMA are the products, the administrator agent, the Buyers, the Sellers and the brokers agents. Each entity is defined in a formal way in the form of a set of characteristics. Moreover the basic activities managed by the Marketplace are defined in the form of a set of functions used by the various entities. These activities gather: The inscription, the removal of the buyer and Seller agents, the maintenance of new products publications from the seller agents and the updates in the prices of the products, the response to the buyer agents on the various requests related to the products, the supply of a mechanism of the seller selection while basing itself on criteria and the requests of the buyers, the management of the various activities of the brokers agents etc[9]. Formally each entity of the system is represented as a record with a set of information. For instance, the seller agent information will be presented in this manner:

- **The seller identifier** associated to each seller. This identifier is used by the broker and the administrator agent in order to identify in a single way the seller.
- **The address** represents the address of the seller contacts.
- **The brokers List** contains all the brokers with which the seller is registered.
- **The list of products to be sold** represent the list of the products that the seller offers. This list contains for each product:
  - The links to the description of the product
  - The asked selling price
  - The reserve price (minimum price)
  - The quantity offered
  - The desired date to sale (to be not exceeded)

The variables used are described as follows:

SellerId : To identify the seller
SbrokersList : The list of the brokers with whom the seller is registered
SAddr : The address of the seller
ProdOffer : Represents the list of the products offered by the seller. The description for each product, is similar to the product requested by the buyer
ProductId : Is a link to the description of the product
SPriceD : Is the desired price
SpriceR : Is the reserve price (the price with which the advertiser wants that a transaction will be concluded)

SQty : Is the offered quantity
SDate : Represents the date before which the seller wishes its products to be sold

Fig.1. shows the structure of an agent seller. The other agents are defined in a similar way except for the variables change.

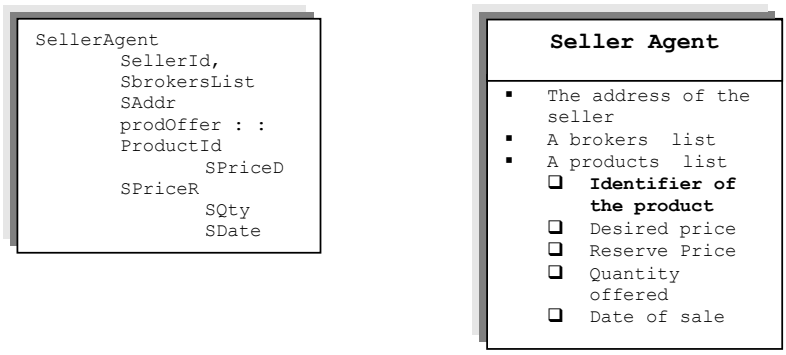

Fig.1: Representation of a seller agent.

3.2 VARIOUS ACTIVITIES OF VEMMA SYSTEM

The basic activities managed by the VEMMA Market place are the registration of the buyer and seller agents, the maintenance of news products offers, the updating of the products prices, the response to the buyer agents on the various requests related to the products and the supply of a mechanism of the sellers selection which is based on criteria. The management of the various activities of the brokers agents, forms also a part of the activities repertory. When these activities take place, the broker must react and make the necessary treatment using information available in his local database. We defined a set of functions necessary to achieve such activities, among them let distinguish the activities listed in Table 1. More than 30 functions shared between the various agents manage the system.

Table 1: A subset of activities functions managed by Vemma

Name of the function	Definition
Add_buyer (BrokerId, BuyerId, Adm)	Add the buyer who has BuyerId as identifier in the list of the broker who has BrokerId as identifier
Del_buyer (BrokerId, BuyerId, Adm)	Remove the buyer from the broker buyers list
Add_seller (BrokerId, SellerId, Adm)	Add a seller
Del_seller (BrokerId, BuyerId, Adm)	Remove a seller
Add_Broker (BrokerId1, Adm)	Add a broker to the system
Del_Broker (BrokerId1, Adm)	Remove a broker
ch_bAddr (BuyerId, Adr, Adm)	Change the buyer address
Add_prodInt (bid, pid, mk)	Add a pid product to the market mk
InformOffer: (SellerId, Offer, Adm)	The seller which have SellerId as identifier announces a new offer (a new product)
chg_BPrice (BuyerId, ProductId, BpriceD, Adm)	Update of the price suggested by the buyer

3.3 A VEMMA FRAMEWORK

Fig. 3 presents the various entities of the system and their functions.

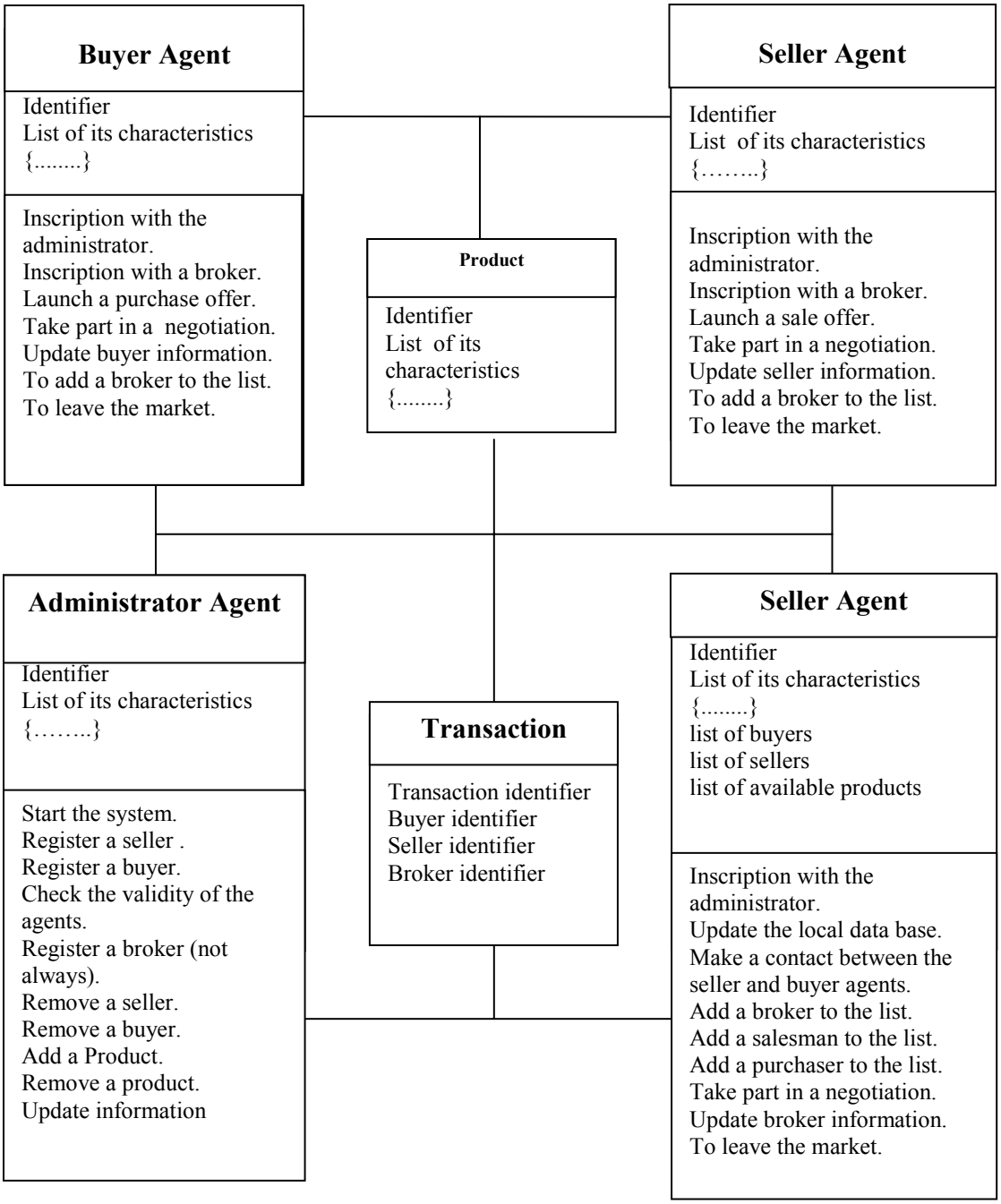

Fig.3: VEMMA Market place Framework

3.4 GENERAL REPRESENTATION OF THE SYSTEM

The formal model describes previously is implemented according to the VEMMA platform of fig.4. It consists of an organizational model carried out by the system procedures. The use of several types of agents for structuring the platform is proposed with the aim of achieving a maximum of flexibility. Concretely, VEMMA is a collection of Java packages, which implements the administrator agent, several agents brokers, various Seller and buyer agents and the basic libraries of messages.

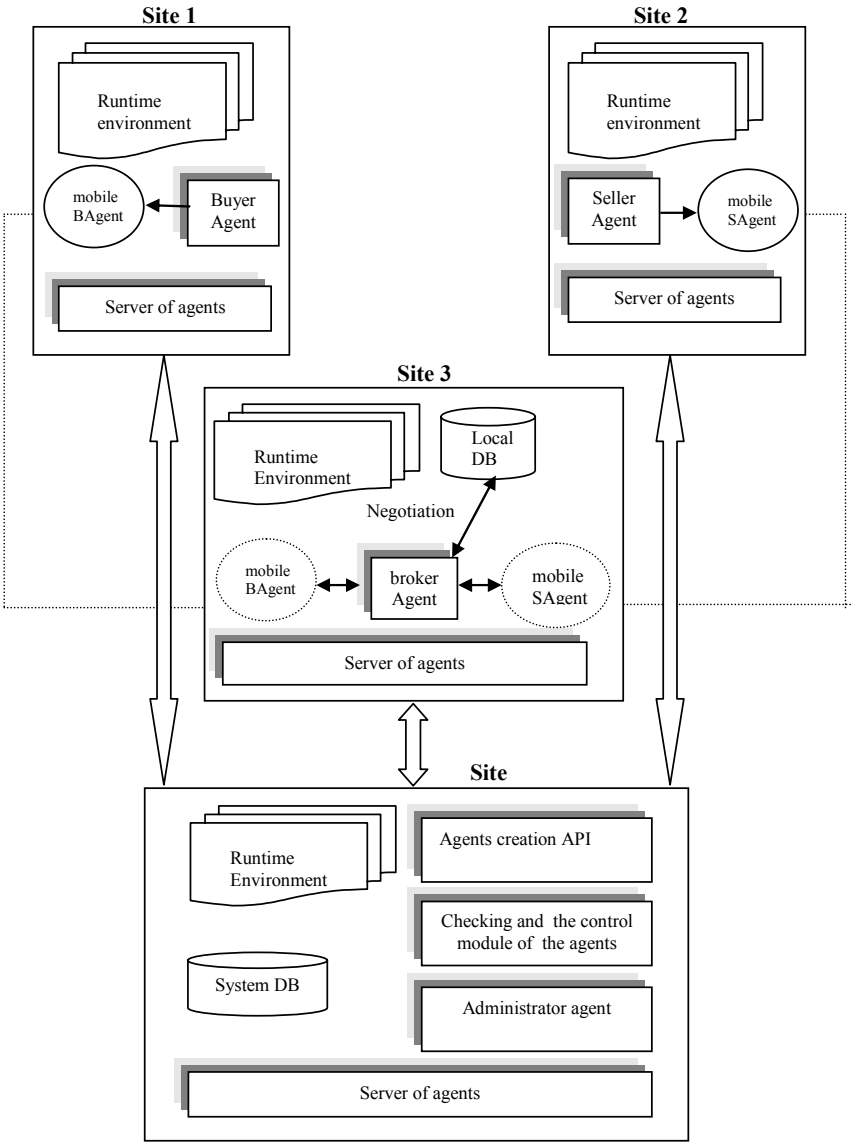

Fig.4: General architecture of VEMMA system.

4. IMPLEMENTATION OF THE VEMMA SYSTEM WITH JAVA AND RMI

The Vemma architecture kernel is a distributed application implemented in Java, by using RMI technology and JDBC-ODBC. The version of Java used is the 2.0 version of Jbuilder which is a visual version of the Java language. This application is a platform which gathers the various entities defined in the Vemma system such as the administrator agent, the seller agent, the buyer agent and the products. In addition to these elements, new functionalities can be added by incorporating methods to the basics classes defined previously.

4.1 GENERAL ARCHITECTURE OF THE KERNEL

The Administrator Agent (AdminAgent). In the RMI terminology, the administrator agent represents the server of the application. It includes two classes, AdminAgent and AdminAgentFrame, the first calls the second in order to visualize the administrator agent graphically. Both classes manage also the access to the database via methods implemented through an interface called AgentApi. AgentApi is a class providing to the buyer and seller agents the syntax of the methods used by the administrator.

The Seller Agent SellerAgent (Buyer Agent BuyerAgent). The seller (buyer) agent is composed of two Java classes, the SellerAgent (BuyerAgent) class and the SellerFrame (BuyerFrame) class. The SellerAgent (BuyerAgent) class calls the SellerFrame (BuyerFrame) class in order to give a visual look to the latter.

The Database. The administrator agent manages a database created with Access 97, and currently contains only the product table. To Connect to this base we use JDBC-ODBC connection, which allows the exploitation of a relational database.

The main VEMMA behavior is illustrated in fig. 5.

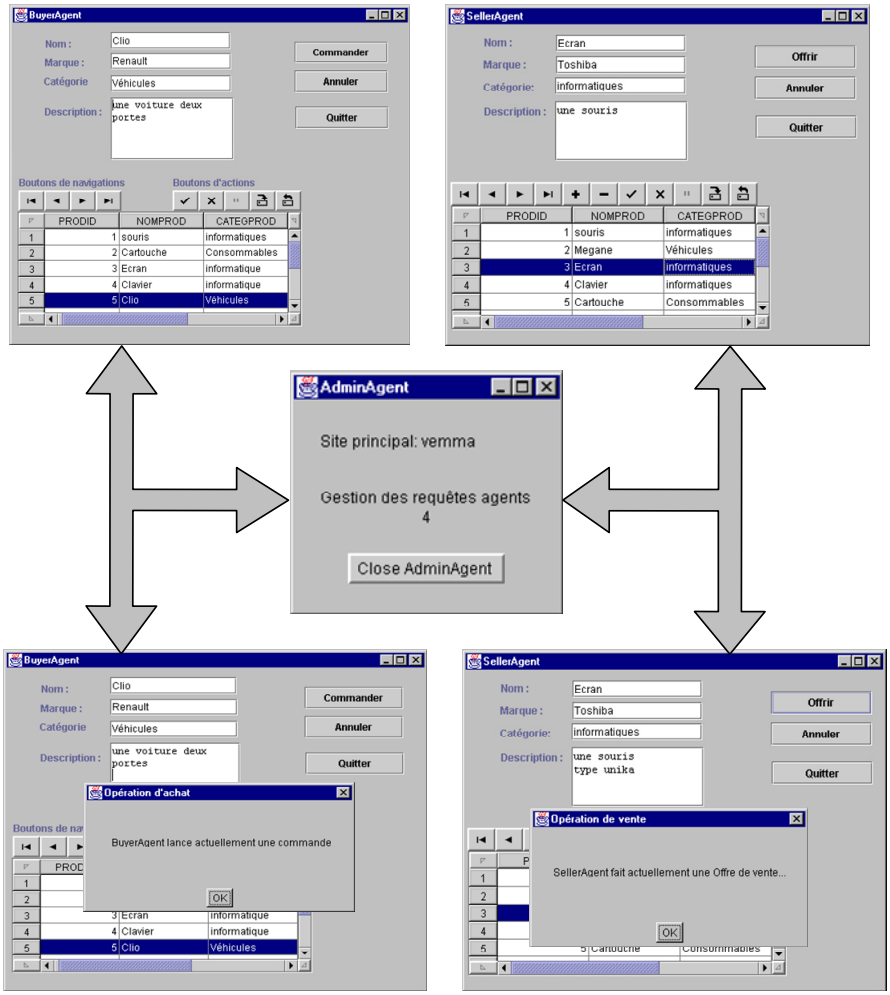

Fig. 5: The kernel architecture

5.0 CONCLUSION

In this work, we have proposed a formal model of a virtual Market place for the sale and the purchase between software agents. This model can be used as a prototype. We have also modeled the behavior of the buyer and seller agents participating in the market as well as the brokers. In addition, we have designed a Marketplace called VEMMA based on agents, which makes possible to automate all the commercial process. The originality of our model lies in the fact that it allows the buyer and seller agents to negotiate by decreasing the traffic network, because these agents will create mobile agents which move to the site of the broker in order to negotiate the product on the spot they wish to acquire.

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