MULTI-AGENTS SYSTEM TO IMPROVE ELECTRONIC MARKET PLACE

[*]*Makhlouf Derdour*
Tebessa University-Algeria
Computer Science Departement
Tebessa – Algeria
m.derdour@yahoo.fr

[**]*Nacira Ghoualmi-Zine*
Badji Mokhtar University-Algeria
Computer Science Department
Annaba - Algeria
ghoualmi@yahoo.fr

ABSTRACT

The uncertain future of the electronic market places (e-MP) brings to wonder about the development of these inter-organizational information systems that joins three types of actor mainly: the operator, the customers and the suppliers. Our work aims to propose an architecture based agent to improve management of e-MP: to add or to withdraw an agent of a system without altering the other components and without to restart again the market place. It will allow us to modify the traditional approach of the commerce by integrating more intelligence, autonomy and automation; which are the most important features of the software agent. We present the necessity of the inescapable consumer/supplier's interfaces easily implemented with the advent of the generalization the object approach and the principle of encapsulation that are associated to them. This can be conceived henceforth like an interaction of software entities, by communication interfaces/programming that they propose. In conception stage we present the existing use cases diagrams in e-MP illustrated by UML. To implement our system we choose Jade platform (Java Agent Develops Frame-work) and Java language. Since our work is based on a Multi-Agents system where agents must communicate between them, we model the exchanged information with KQML language (Knowledge Query Modeling Language) that permits to define a uniform communication between different agents of the e-MP system. We translate the model of information in XML vocabulary and message's transfer messages by RMI/IIOP/Java event according to the type of communication. Results are:-The widening of the E-MP's offer, -Agent's integration to measure the performances of the enterprise based upon E-MP, -The security of the exchanges, -The interoperability between E-MP, -flexibility of e-MP.

Keywords: *Electronic Place of Market (E-PM), multi-agents system (SMA), Customer, Seller, E-Commerce.*

1. INTRODUCTION

A traditional market is generally limited to two interlocutors, the customer (seller) who needs to buy (to sell) a product or a service, he moves personally to the market and looks for a seller (customer).

The two parts debate a transaction and finally reach an agreement. The transaction ends when the product is delivered once the customer pay the seller. However, we observe that the relation within the market places is based upon the delegation of a task. Indeed, the exchangers (customers and suppliers) delegate to the operator of the place the management of the informational exchanges.

On one hand the advent of the Internet with its distributed and dynamic characteristics brought efficient, flexible and reliable solutions for the enterprises, and notably for the development of applications as the electronic commerce, the virtual enterprises, and the cooperative information systems (CIS). The objective is to offer: -The mobility that allows customer to move merely while keeping the personal access to the information system (IS) (mobility of services and personals). -The data warehouse that gathers the data bases and permits adaptation to the demand. -The storage of information that represents the on line available wealth. The cooperative work (cooperate to decide better). On the other hand the expansion of the electronic commerce, notably with the apparition of the direct sales to the consumers by the slant of Internet, came with the extensively widespread idea that all enterprise anxious to preserve positioning on the market must endow itself of on line sale capacities. So an electronic market place [**9**] is a virtual place where participants to a business of specific sector, are distributed geographically and they don't know each others. They act reciprocally with the intention to satisfy a common business objective. One of the features that detach itself of this electronic market definition is, probably, the geographical distribution of the participants. This factor implies that the market is sustained by an infrastructure of information, and a robust and a coherent communication. According to Bakos [**9**], markets (electronic or traditional), possess three main functions:

1 - To establish the relation between customers and sellers.
2 - To facilitate the exchange of information, products, services and payments.
3 - To provide an institutional infrastructure.

The delegated task goes from the simple setting in computer relation until to the negotiation and to the realization of the transactions. This delegation constitutes a problem of proxy because, if one supposes that the actors act in order to maximize their function of utility in a rational manner but limited, all necessary conditions are united **[4]**:
The environment is strongly uncertain since the sector of the market places is even unsteady. An asymmetry of information exists between the exchangers and the operator, who as a mediator; possesses a general view of the market, of the prices and of the actors. The operator and the exchangers can have divergent interests because the mediator distinguishes himself of principals in terms of "patience, aversion to the risk, price of booking or costs of opportunity" [**12**].
The article is composed after the introduction of a motivation that pushes us to write the present article, then we present the commerce and the places of electronic market briefly, then the use of the software agents for the implementation of the electronic market places, thereafter we present our contribution in term of conception of e-MP. Finally, we finish by a conclusion with perspectives.

2. THE MOTIVATIONS

The motivations of our interest to e-MP are two: The first, an enterprise that doesn't sell on Internet risks to lose profit and customers using internet. So, this analysis is especially valid in terms of perspectives since the analysts recognize that the electronic commerce is going to continue to progress. The second is that the electronic commerce generates gains of productivity. This idea, shared by many analysts, leans on the following propositions:

- the technologies of information are permitting to manage efficiently more resources;
- the use of Internet will entail the reduction of some expenses (buildings, personals of sale);
- some administrative tasks, bound to the commercial transactions, will be automated;
- the markets will be more transparent;
- The market places on the Web, will allow the enterprises and the final consumers to enter in contact, without intermediary, making thus useless the role of some mediators.
- The advertisement especially for the small enterprises.

3. ELECTRONIC COMMERCE

We distinguish **[11]** the commerce between enterprises for B2B (Business to Business) and the commerce with particular person B2C for (Business to Consumer). If the B2C is put more forward today by the medias, the B2B on Internet as out Internet is very important. There are new categories that also appear as the commerce with the administrations (Business to Government) and the commerce between individual persons (Consumer to Consumer)... etc. For any type of commerce we use Internet or an electronic material for order, payment and the delivery is done by abstracted manner or by traditional methods.
The electronic commerce crossed three main phases:

- The first phase is characterized by the use of the EDI (Electronic Data Interchange) or electronic Exchange information that permits the exchanges of data from computer to computer (or application to application) according to pre-established messages and normalized via an electronic communication mode.
- The second phase is marked by the apparition of the electronic Market place (E-MP), that permits to the customers to meet the on line sellers without obstacles of the classic markets.
- The third phase is the phase of the use of the Intelligent Agents as mediators to achieve the most tasks of the electronic commerce.

3.1. ELECTRONIC COMMERCE SCRIPT

To make electronic commerce on Internet is very similar to make the commerce every day, at local commerce man, in a supermarket or in a department store. The big stages of a purchase can be summarized in the following way:

- The first phase is the purchase phase where the customer browses different stores in quest of one or several articles.
- Once the purchase decision is taken with its known conditions, the customer order. The customer and the seller must agree the method of payment: counting, banking card, credit card, check, etc.
- Once the method of payment is chosen, the customer pays. He must verify the amount, must give the information of payment (for a credit card, the number of the card and the date of expiration) and must sign the payment in an electronic way. This payment allowed by the customer's bank.
- Once the payment is done, the seller must assure the delivery.

3.2. ADVANTAGES OF THE ELECTRONIC COMMERCE

The electronic commerce **[5]** permits to the companies to be more efficient and supple in their internal operations, to work more closely with their suppliers and to be more sensitive to the needs and to the waiting of their customers. The main advantages joined to the electronic commerce, of the point of view of the enterprises are:

- Reduced costs of purchase and storage
- Less mistakes of treatment
- Reduced Time of setting market
- Better service to the customer
- Opening the markets

The advantages of the electronic commerce for the consumers are:

- Multiple choices
- increased Convenience
- More completed information
- Lower costs

The advantages for public services are:

- Services more accessible and more convenient (public services, television - training, information on health)
- Faster answer
- More complete information
- Reduced working cost for the governments, the citizens and the enterprises

4. THE ELECTRONIC MARKET PLACE

An electronic market place is composed of a set of on line services permitting the closeness on the one hand between suppliers and costumer, and on the other hand, the dematerialization and the automation of a part or the totality of the fluxes of information and transactions participating in the global process of purchase, of the definition of the needs (specifications) to the satisfaction of those here (receipt and payment of the benefits).

The disadvantages of EDI's are: the elevated costs, the rigidity of working and the absence of the interoperability, drove to the birth of the market places that aims to **[10]**:

- spread the number of the participants to the electronic exchanges, the nature of the possible transactions and the types of products and exchanged services;
- combine the advantages of the EDI (direct exchanges between systems of management) and those opened on Internet (opening in the E-MP, exchanges between enterprises not having between them a previous relation, use of the Web technologies);
- use in the world of the B2B the techniques of the bids, of the reversed bids, that appeared first (with various successes) in the commerce between individual person;
- To coordinate the multiple actors susceptible to participate in a complex provision chain.

4.1. TYPES OF MARKET PLACES

Today, it exist three types of market places:

- The public or transverse market places: they allow the enterprises to achieve all purchases that don't concern the production on a same Internet site; these are the e-MP "start-up" that proposes on line many electronic catalogs but that don't assure the transactions;
- The vertical market places: they concern a branch of the industry or a market of "dog house"; the sectors pioneers are the chemistry, the car and the building; the recent market places" path woods" that have just appeared are part of this category;
- The private market places: they are on the initiative of an industrial or a group of industrial that wishes to gather the set of these suppliers on an Internet site in a virtual network of enterprises for the management of the stores.

5. THE AGENT APPROACH FOR E-MP

Concerning the systems of electronic commerce based agents; we have Firefly for example of PersonnaLogic. The major disadvantage of these two systems is the absence of a help system to research sellers. Another system called Jango offers more features of the product to look for and permits research while using the predefined categories. We also have the approach proposed by Timothy **[14]** that spreads the models of confidence and reputation to consider the competences of the agents. Another approach proposed by Steven **[13]** takes the integrative negotiation like a more appropriate approach to sell in detail. The different generations of the purchase agents are limited today to compare leading offers only on prices instead of their range full of value. They make wrong service to the consumers because they hide important and considerable services to the consumer.

In order to manage the e-MP, we propose a Multi agents system **[4]** that assures the transparency in all transaction between customer/supplier and that guarantees a certain degree of confidence to the users of the e-MP. Indeed, the use of the agent technology appears to be the best approach in the electronic commerce, since the agents can sell, buy and represent the interests of their owners (customers or suppliers); These agents used like mediators are going to revolutionize this kind of commerce and can reduce the costs of the commercial transactions implied in general in the electronic commerce, and in the commerce of B2C type, in particular.

This solution requires few materials because it takes software agents as a basis and permits to benefit from the advantages of the Multi-Agents systems such distribution, cooperation and coordination **[10]** in an open system. So, we get a system having the following features:

- To make the system more reactive,
- To automate the process of management of the e-MP in order to avoid a maximum of human's presence,
- To achieve an autonomous system for the sale, the purchase and the management.
- To propose a distributed and an active system for the management of the e-MP.

6. CONCEPTION AND ARCHITECTURE OF E-MP

We propose an architecture based agent to improve management of the e-MP. We propose a system composed of four types of agents (administrator, consumer, seller and manager) every agent is endowed with a defined function. The administrator agent must be available in the e-MP. Each agent has a unique identifier represented by a unique series number and a hidden password inside the agent's code. So, consumer/sellers have to identify the customer through a set of information:

login_customer, password_customer, N°_agent, password_agent). In order to factorize the authentication of the customers in the e-MP, figure.1 illustrates the different type of customers in e-MP.

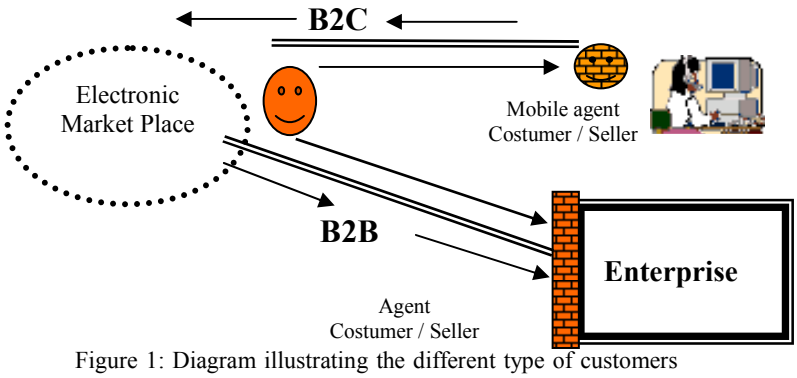

Figure 1: Diagram illustrating the different type of customers in e-MP

To assure a new kind of services called mobile services we propose to use mobile agents. This allows customer to move while keeping access to the e-MP.

6.1. ARCHITECTURE OF THE E-MP SYSTEM

The proposed system is a set of organized agents according to the fulfilling task (see Figure.2. The Administrator agent is going to create a manager agent to manage the transactions between the costumer agent and the seller agent. The manager agent assures a secured communication between the costumer and seller of the same type of service.

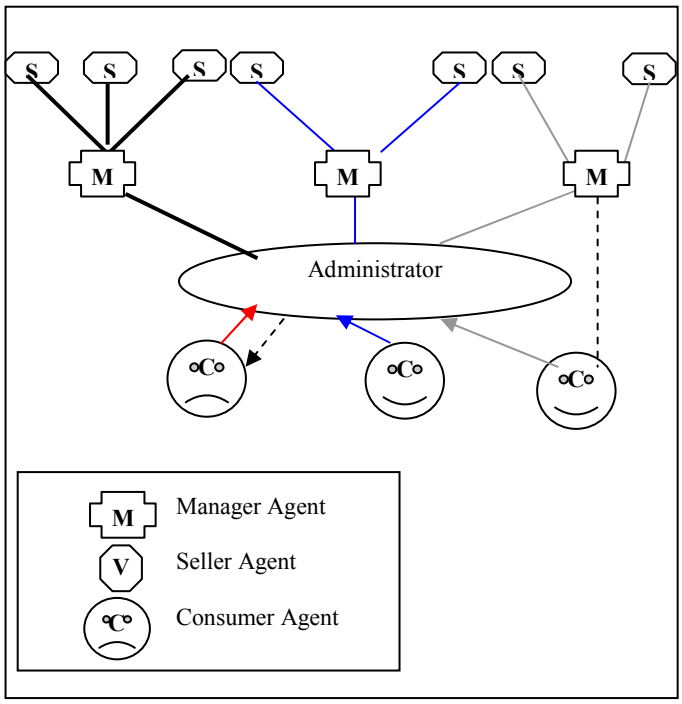

Figure 2: Global architecture of the system

6.2. SPECIFICATIONS OF THE SYSTEM

- To enter market place, a consumer, seller or even a visitor must subscribe to the responsible agent to provide him consumer or seller agents according to the activity.
- The consumer or seller agents allow the user to open a secured session of the market place. This allows a communication and the process of purchase/sale (negotiation) more reliable and efficient. Then the consumer/seller agent becomes the user's representative in the market place. So each user, consumer or a seller is represented by an agent that contains protocols of negotiation (is a discussion in which interested individuals exchange some information and arrive to an agreement in common) to conclude the transaction purchase/sale.
- For the seller agent, the user gives him services or objects to sell. So, the seller agent subscribes them to the manager agent charged sold services and objects.
- A consumer agent send requests the manager agent charged of sold objects or services in which he specify that he wants to buy. So the manager agent establishes a communication between the consumer's agents and the seller's agents for the same types of services or objects.
- The consumer/seller agent is considered like an intelligent card: it is identified by a unique identifier inside every agent.

7. DIAGRAMS OF USE CASES

We have four distinct actors (Administrator, manager, Seller and consumer), so we have four sets of case of use:

THE CONSUMER

An agent that comes to buy activities and services beside the market place

- In this case the system must be able to display services, activities, products… etc.

Description: case of a consumer

1. To search for a seller
2. to receive an answer
3. to ask for a price
4. to receive the price
5. to send a demand of transaction
6. to negotiate
7. to do the purchase

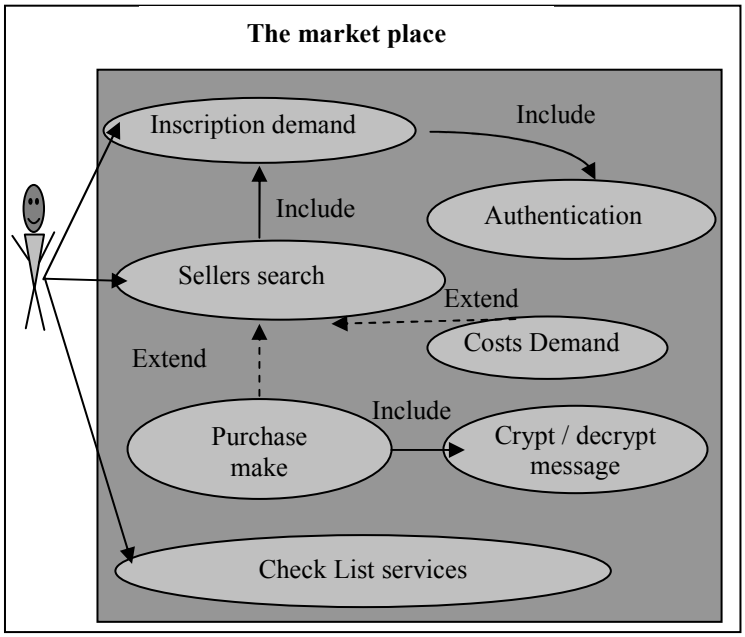

Figure 3: DUC of the consumer agent

THE SELLER

It is an agent that comes to sell activities and services in the market place

- In this case the system must be able to save services, activities and products proposed by this agent.

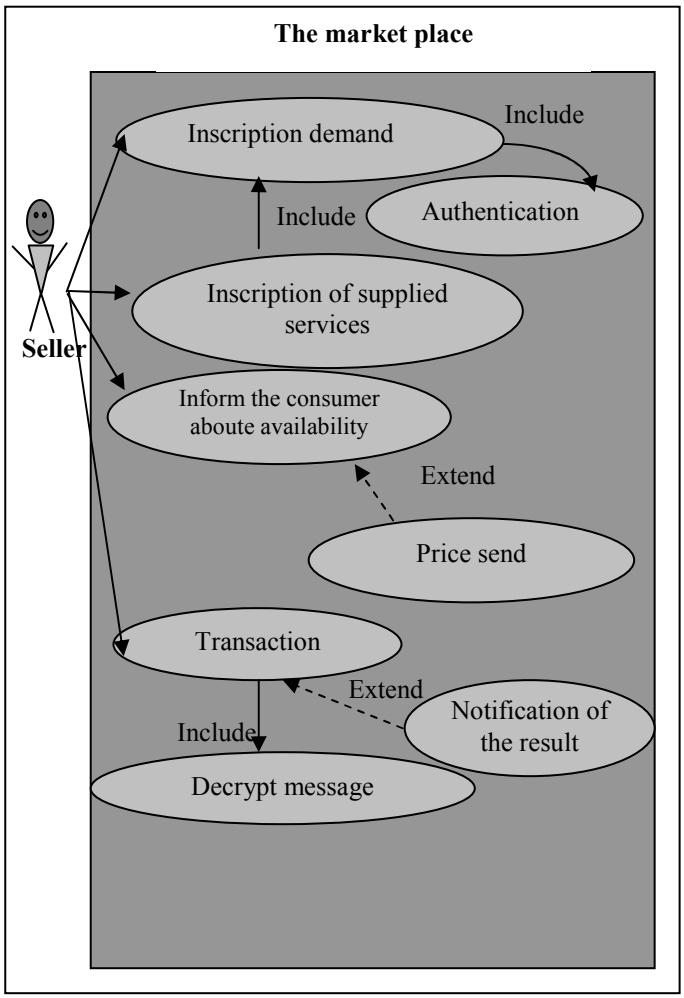

Figure 4: DUC of the seller agent

Description: case of a seller

1. To receive a request of availability
2. to inform the consumer on the availability
3. to receive a request for price
4. to send the price
5. to receive a demand of transaction
6. to negotiate
7. to notify the result of the transaction

THE ADMINISTRATOR

It is an agent like a demon. It assures that all functions are well fulfilling of the infrastructure of the market place.

- The system must provide the list of the seller's agents with the proposed services.
- The administrator agent must be able to make some updates on the market place.
- The system must provide the list of the service categories and the administrator must be able to modify them (to add and/or to withdraw from the market place a manager agent).

Description: case where an agent wants to subscribe to an activity by the administrator agent.

- The administrator agent receives a demand of subscription on behalf of a seller/ consumer.
- The administrator agent authenticates the customer.
- The administrator agent verifies that there are enough places in the market place.
- The administrator agent enrolls the agent in the case when the authentication is done with success.

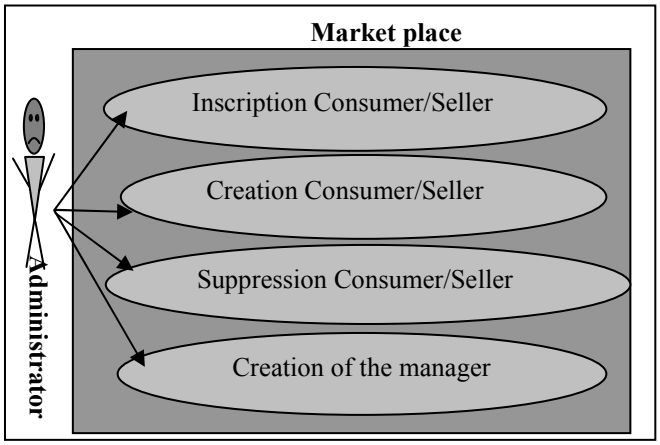

Figure 5: DUC of the administrator agent

THE MANAGER

A monitor is an employee who assigns to lead the activities, and to frame the customers.

- He must be able to create the planning of the activities of which he is responsible
- To modify his planning
- To create and to provide the keys of sessions to the consumers / sellers agents

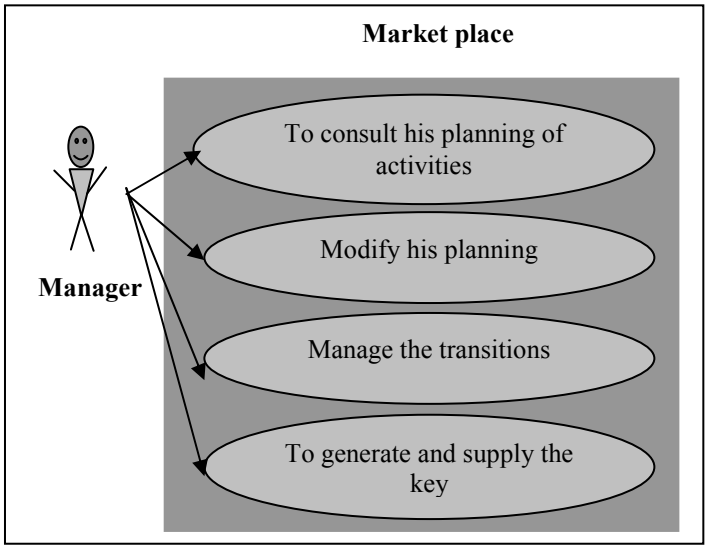

Figure 6: DUC of the manager agent

8. THE IMPLEMENTATION

To implement our system, we use Jade platform (Java Agent Development Frame-work) and Java language.

Because in Multi-Agents system agents must communicate between them; we have modeled the exchanged information with KQML language (Knowledge Query Modeling Language) that permits to define a uniform communication between the various types of agent existing in the systems. So, we translate

the model of information in XML vocabulary, RMI/IIOP/Java assures the message's transfer according to the type of communication. **[6]**

The administrator agent

To create a manager agent:

```
DFAgentDescription manager = new DFAgentDescription()
Manager.setName(this.getAID());
```

The seller agent

To create the service description:

```
ServiceDescription Service_ Des = new ServiceDescription();
Service_ Des.setType(<service_ name_type >);
Service_Des.setName(<service_name>);
```

Save the service beside the manager agent

```
manager.addServices(service_Des);
Try {DFService.register(this, manager);}
Catch (FIPAException e) {<code d'erreur>}
```

The consumer agent

Create the agent description

```
DFAgentDescription consumer = new DFAgentDescription();
```

Fined the agents in a chart

```
DFAgentDescription[] result =DFService.search(this,
Purchaser);
```

To skim the char to recover the agents

```
for (int i=0; i<result.length; i++) {
```

Iterator iter = result[i].getAllServices();

Recover all the services descriptions

```
While (iter.hasNext()) {
ServiceDescription service_ Des =
(ServiceDescription)iter.next();
```

< Treatment on the services>}}

9. CONCLUSION

The implementation of electronic market place is an auspicious opportunity to transform the enterprise and the domain of its activity; it permits to reduce costs, to optimize relations between the customers and the suppliers in order to reinforce the competitiveness. The goal of the present work is to integrate the paradigm agents and the Multi agents systems in the management of electronic market places E-MP in order to improve E-MP by the added value brought by the MAS. These will permit the automation of the repetitive, complex and trying tasks. These tasks are associated to the commercial processes, and are done traditionally by human users. Among the most important tasks in the commercial processes, we can mention the research of the products or objects, the research of the suppliers and the negotiation of the prices and services to buy or to sell. The architecture of the E-MP based MAS improves the performances because the E-MP based agent permits:

- The widening of the E-MP's offer
- Agent's integration to measure the performances of the enterprise based upon E-MP
- The security of the exchanges
- The interoperability between E-MP

To extend our work, we'll adopt the mobile agents and develop the interoperability between E-MP.

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