Interaction Protocols for Electronic Institutions in B2B inter-organizational business

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Methodologies for Scientific Research
Outline

- Introduction
- FIPA-Contract-Net
- Implemented Electronic Platform
- Scenario
- Conclusion
Introduction

- Information Technology and Communication

- Electronic commerce
  - business-to-consumer (B2C)
  - business-to-business (B2B)

- New era of the digital economy
Introduction

- **Electronic Institutions**
  - to support interaction between representative artificial agents of business activity participants (enterprises) as a coordination framework, making the business agreement establishment more efficient

- **Multi-Agent System (MAS)**
  - Interaction infrastructure

- **The FIPA-Contract-Net protocol**
The FIPA-Contract-Net specification.

The Initiator

The Participants

Deadline for proposals

The Initiator

The Participants
Implemented Electronic Platform

- A Multi-Agent system as Electronic Platform.
  - FIPA specification protocols.
  - JADE (Java Agent Development Framework).

- It has Buyer and Supplier agents

- Infrastructure of participant agent’s communication
  - Behaviours
  - JADE
    - ContractNetInitiator
    - ContractNetResponder
Implemented Electronic Platform

- The participant agents in JADE were divided into categories:
  - the Initiator
  - the Participants

- Three protocols were defined, which are:
  - open protocol,
  - proposal protocol and
  - closing protocol.
Implemented Electronic Platform

- The two developed main agents are: Supplier and Buyer.
- The Buyer agent:
  - Subscribes in a Virtual Marketplace;
  - Finds the Supplier agents that met themselves in the Virtual Marketplace, only those that able to satisfy your needs.
  - Requests proposals from all Supplier agents;
  - Analises the received proposals from Supplier agents;
  - Chooses the best proposal;
  - And, to send a message toward supplier agent that offered the best proposal;
Implemented Electronic Platform

The Supplier agent:

- Subscribes itself in a Virtual Marketplace;
- Registers your services in the yellow pages;
- Has a data structure to ensures your product catalogue;
- Waits by proposal requisition from Buyer agents;
- Formulates proposals for a Buyer agent;
- Announces and to officialize the Buyer agent, in toward to accept the conditions and compromises itself to realize the agreement;
Implemented Electronic Platform

Table 1 below shows the Buyer and Supplier agent’s behaviors associated with yours respective tasks.

**Table 1. Behaviours list associated to the Buyer and Supplier agents**

<table>
<thead>
<tr>
<th>Agents</th>
<th>Behaviors</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer</td>
<td>WakeBehaviour</td>
<td>Start up the agent execution and, also, it queries DF (Directory Facilitador) agent.</td>
</tr>
<tr>
<td></td>
<td>OneShotBehaviour</td>
<td>Send a message toward Supplier agents.</td>
</tr>
<tr>
<td></td>
<td>Generic Behaviour</td>
<td>Stay waiting by responses of Supplier agents.</td>
</tr>
<tr>
<td></td>
<td>Generic Behaviour</td>
<td>Determine the winner, the agent that offers the best proposal.</td>
</tr>
<tr>
<td>Supplier</td>
<td>OneShotBehaviour</td>
<td>Start up the agent execution and register itself in the yellow pages services (the DF agent).</td>
</tr>
<tr>
<td></td>
<td>CyclicBehaviour</td>
<td>Analise the CFP (Call For Proposals) from Buyer agent.</td>
</tr>
<tr>
<td></td>
<td>CyclicBehaviour</td>
<td>Verify himself whether won the dispute and compromises itself with agreement.</td>
</tr>
</tbody>
</table>
Scenario

Supplier Agent

- A Virtual Marketplace starts with clusters of the Supplier Agents.

- Each Supplier agent in the beginning performs his OneShotBehaviour behavior.
  - Creates two objects: Fabric and Catalog.

- The next behavior to be performed is the CyclicBehaviour.
  - It to elaborate a proposal.

- The last behavior is the CyclicBehaviour.
  - The Supplier agents wins the dispute.
Scenario

Buyer Agent

- Starts the negotiation using OneShotBehaviour;
  - DF (Directory Facilitator)
- The other behavior to be executed is a generic behavior

- By last, the Buyer agent performs other generic behavior that fulfills two tasks.
  - To determine the best proposal received from the Buyer agents
  - To send a message to winning agent with the accept-proposal performative, the other agents receive refuse-proposal.
Scenario

- The Supplier agents
  - s1, s2 and s3

- Buyer agents
  - b1, b2, b3 and b4
    - Target good: cotton, chiffon, voile and nylon respectively.
Scenario

Ocurrers following steps:

- The agents s1, s2 and s3 meet themselves to constitute the Virtual Marketplace;
- Each agent offers its products with the respective available quantity, that was randomly attributed;
- The agents keep updated the product’s quantities;

- The Buyer agents make a CFP for Supplier agents through the open protocol aiming to receive proposals;

- The Supplier agents elaborate proposals through the proposal protocol and send them to the Buyer agent;

- The Buyer agent selects the best proposal received taking into account several situations, not only the best price using the proposal protocol;

- Following the Supplier agent, the contracted, firms an agreement with the Buyer through the closing protocol;
Scenario

- The Figure 2 below shows the exchanges of messages between the supplier agents and buyer agents in the negotiation.

**Fig. 2.** Exchange of messages between the Supplier and Buyer agents in the negotiation.
Conclusion

- The interaction protocols between the participating agents in the inter-organizational B2B negotiation process we defined a SMA to ensure an Electronic Platform.

- We developed an Electronin Platform, the textile industry, for the negotiation between the participating agents.

- A detailed overview of operation of how the agents perform their tasks was described.

- The purpose of this paper resulted in the following contributions: 1) the three protocols of negotiation for B2B transactions, which was based specification from the FIPA-Contract-Net.

- This study is the basis for the implementation of a trading algorithm more powerful, the trading algorithm-Q (Rocha, 2001).
Thank You!

Questions?