

Multi-agent Systems in Building a Computational Middleware

André Filipe de Moraes Batista, Maria das Graças Bruno Marietto
Federal University of ABC. São Paulo, Brazil.
{andre.batista, graca.marietto}@ufabc.edu.br

Abstract

Multi-agent systems are a focus of research in Distributed Artificial Intelligence that aims at the development of autonomous entities specialized in certain tasks. This paper presents the construction of a prototype of a multi-agent chatterbot who answers questions about the JAAS Java API.

1. Introduction

Distributed Artificial Intelligence (DAI) examines social and technical aspects of computer systems, presenting new and more comprehensive ways to problem solving, programming languages, planning, representation of knowledge, etc. One of the focuses of research in DAI are called Multi-agent Systems (MAS). A MAS is a set of autonomous entities (agents) specializing in certain tasks, which cooperate and/or compete with each other to achieve individual goals and/or collective [1][2][3].

This study developed a prototype MAS where agents are seen as basic building blocks from which services of a computing environment can be oblivious, organized and constructed. As an example of application of the middleware layer, a chatterbot that answers questions about the JAAS (Java Authentication and Authorization Service) API was implemented.

2. Chatterbots: An Aid to Human-Machine Interface

Since the decade of the 50, Artificial Intelligence area is developing research programs and software to give the computer the ability to converse with humans in a natural way. These programs are called chatterbots (robots with the ability to talk). These try to simulate a human being in conversation with people. The goal is to answer the questions so that people have the impression from talking to another person and not with a computer program. After sending of questions in a natural language the program consults a knowledge base and then

provides a response that tries to mimic human behavior [4].

Another type of chatterbot very spread is FAQBots - bots responsible for responding to simple and frequently questions of users on the subject its base of FAQs (Frequent Asked Questions). For example, providing information on a company, or on products sold by this company. These robots can also be used in virtual environments to study, to answer questions from students about the subject being studied. They have the same utility of a base of FAQs, but offer to the user the advantage they can formulate their questions in natural language and obtain different answers depending on factors of context [1][4].

This type of bot is not intended to pass for human, and not try to speak on matters not related to the question of the user. When there is no known answer to a question put by the user, is preferable to assume ignorance, thus avoiding an inadequate response. The chatterbot developed in this work is a FAQ.

2. Multi-Agent Prototype

The prototype is implemented back to the modeling of a chatterbot to be used in educational virtual environments, providing the interface when the direction of the student for clarification of doubt more frequent.

Figure 1 illustrates the architecture of the prototype developed. In step (1) the user sends the question to chatterbot using a JSP page. In (2) the agent gateway (a middleware agent) receives the question and sends to the chatterbot (3). The chatterbot consulting its knowledge base (4), containing sentences of the language AIML. The chatterbot forwards the response to the agent gateway (5) responsible for delivering the answer to the correct user. In (6) and (7), the answer is displayed to the user in the JSP page.

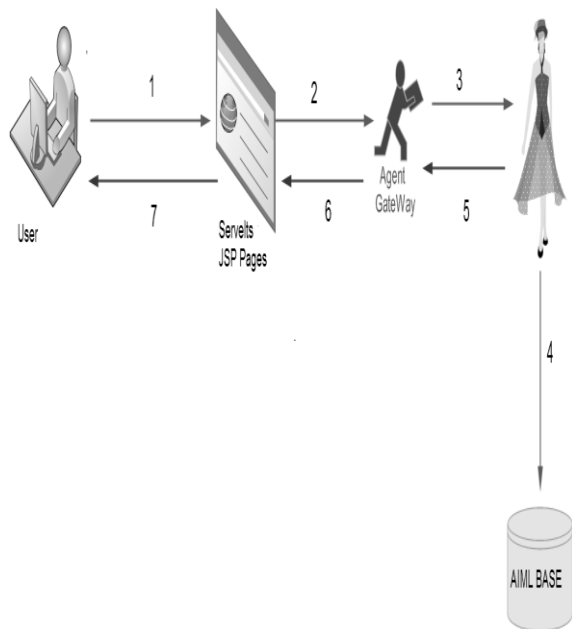


Figure 1 – Architecture of the developed prototype.

To develop this project we use the JADE [1] (Java Agent Development Framework) agent platform. With use of this and technologies such as Java Server Pages, Apache Tomcat server, Artificial Intelligence Markup Language (AIML) and Rebecca AIML interpreter could integrate the SMA on the Internet, making the natural distribution of these systems to become more involved.

Based on this architecture we developed a prototype that allowed the testing of the structure an agent chatterbot. This prototype will help on questions regarding the JAAS API, developed by Sun Microsystems with the aim of facilitating the use of authentication mechanisms. With this API using these mechanisms is independent of the Java application without the need to change the source code of the application when is necessary to change the authentication mechanism or add a new mechanism.

3. Final Considerations

This work was presented the architecture of a system that uses the JADE multi-agent platform as an intermediary layer, enabling applications that are included in computing environments.

Specifically the target of this prototype was the construction of a chatterbot that answers most frequent questions about the JAAS API. However, the modeling of the chatterbot is generic, allowing the robot deals with different areas.

This proposal was based on the fact that dialogue with a chatterbot tends to become more attractive to student than the mere reading of a text, it calls this an

active participation in the process of communication.

The JADE platform, along with all the tools used in construction of the prototype, provided a middleware layer that does not necessarily need to be used for chatterbots. This layer can take all the multi-agent dynamics and distribution inherent in the Internet to manage networked computing environments, among other applications.

4. References

- [1] Bellifemine, F. L.; Caire, G.; Greenwood, D. Developing Multi-Agent Systems with JADE: John Wiley & Sons, 2007.
- [2] Bittencourt, G. Inteligência Artificial Distribuída. 2006.
- [3] Marietto, M. das G. B. Definição Dinâmica de Estratégias Instrucionais em Sistemas de Tutoria Inteligente: Uma Abordagem Multiagentes na WWW. Tese de Doutorado. ITA, 2008.
- [4] Teixeira, S.; Menezes C. S. de. Facilitando o uso de ambientes virtuais através de agentes de conversação. XIV Simpósio Brasileiro de Informática na Educação, 2003.