Reputation-based Service Discovery in Multi-Agents Systems

Sung-Jun Na, Kee-Hyun Choi, and Dong-Ryeol Shin
School of Information and Communication Engineering
Sungkyunkwan University
300 Cheoncheon-dong Jangan-gu Suwon, Gyeonggi-do 440-756, Korea
{nsj3802, gyunee, drshin}@ece.skku.ac.kr

Abstract

Reputation has recently received considerable attention within a number of disciplines such as distributed artificial intelligence, economics, evolutionary biology, and among others. Most papers about reputation provide an intuitive approach to reputation which appeals to common experiences without clarifying whether their use of reputation is similar or different from those used by others.

DF provides a Yellow Pages service. Agents in the FIPA-compliant agent system can provide services to others, and store these services in the DF of the multi-agent system. However, existing DF cannot detect the fake service which is registered by malicious agent. So, a user may search these fault services.

In this paper, we analyze the DF's problem and propose the solution. We describe the Reputation mechanism for searching these fake services. Reputation function assumes the presence of other agent who can provide ratings for other agents that are reflective of the performance or behavior of the corresponding agents.

1. Introduction

A Software Agent System (or Multi-Agent System (MAS)) is a computational environment in which individual software agents interact with each other, sometime in a cooperative manner, sometimes in a competitive manner, and sometimes autonomously pursuing their individual goals, accessing resources and services of the environment, and occasionally producing results for the entities that initiated those software agents [1]. Software agents offer a new paradigm for very large scale distributed heterogeneous applications. According to development of agent technology, the Foundation for Intelligent Physical Agents (FIPA) establishes multi-agent system standards for the promotion of agent-based technology and interoperability of these standards in 1996.

Our method is to introduce reputation mechanism in ubiquitous environment to solve the problem of lack trust by using multi-agent system. We propose a reputation-based service discovery in multi-agent system, reputation-based DF, to take the reputation information that is locally generated as a result of an interaction between agents, and spread it throughout the network to produce a global reputation based on agents' semantic similarity.

The rest of this paper is organized as follows. We inspect some related work in Section 2. Section 3 introduces proposed reputation-based DF. Section 4 concludes the paper.

2. Related Work

2.1. Reputation Mechanism

Service discovery has been defined as "the act of locating a machine-processible description of a (Web) service that may have been previously unknown and that meets certain functional criteria [2]." The process of service discovery is important as it allows the service requester and the service provider to agree on the semantics that will govern the interaction. Service discovery can be broadly classified as manual or automated.

Existing discovery techniques expect the user to use a discovery tool to conduct a keyword search and select the service required. Existing discovery requires the user to have low-level knowledge, for example the user has to ensure that the semantics of the service available match with the requirements. In case a service cannot be found, it is up to the user to locate a combination of services, if available, that can fulfill the requirements. Such a composition of services to achieve some desired end result has been an important

978-0-7695-3317-9/08 $25.00 © 2008 IEEE
DOI 10.1109/IWSCA.2008.21

IEEE computer society

research area in recent years. Reputation models in online communities have been discussed separately from the matchmaking process in many research activities. Reputation mechanisms offer a novel and efficient way of ensuring the necessary level of trust which is essential to the functioning of any market. They are based on the observation that agent strategies change when we consider that interactions are repeated: the other party will remember past cheating, and changes its terms of business accordingly in the future. In this case, the expected future gains due to future transactions in which the agent has a higher reputation can offset the loss incurred by not cheating in the present transaction.

The reputation mechanism aggregates feedback into meaningful reputation information that is made available to the agents [3]. The goal of our mechanism is to protect the trusting agent against cheating from the trusted agent, and to inflict an efficient equilibrium in the environment. The two goals are interrelated. A RM that effectively protects trustors against trustees will drive the defective trustees out of the market and hence achieve an efficient equilibrium. The other way round, a RM that achieves efficiency also guarantees to the trustors that they will benefit from cooperative interactions.

3. Proposed Architecture

3.1. Reputation-based Directory Facilitator

In the following paragraphs we will present the consideration for a reputation-based DF.

First, data consistency should be satisfied between heterogeneous agent platforms. The problem of data inconsistency is necessarily occurred between agent platforms when operations such as registration, deletion, and modification are used.

Second, the proposed DF needs a standard definition of resources such as service type, location, agent's name, and agent's rating.

Figure 1 illustrates the architecture of our proposed reputation-based DF.

JNI module is that are communicate for C language-based agent and Java-based DF. ACL processor modules have two type of operation. Decoder is parsing the ACL message. Encoder is assembling the ACL message. Content processor module is that extract content message at ACL message. Description repository is store that existential agent provide description for service. DF function module is that perform operations such as registration, deletion, and modification between DF and agent. Reputation Function module have a perception message between DF and Reputation database. Also, this module is extract information such as rating of service.

Trust management uses the Web Ontology Language OWL to define ontologies for context representation and modeling, performs rule-based logical inference for context reasoning and knowledge maintenance, and provides a policy language for users to control the sharing of their private information.

What constitutes "good" reputation is a subjective criterion. Users may also want services that have good reputation ratings in multiple contexts (at once accessibility and reliability). Each service in our service discovery has a set of attributes which define the behavior and the capabilities of the service. Services may be compared with each other based on such attributes. The reputation manager service collects and processes service ratings from consumers, stores service reputation scores in a Rating Database (Rating DB), and provides the scores when requested by the discovery agent.

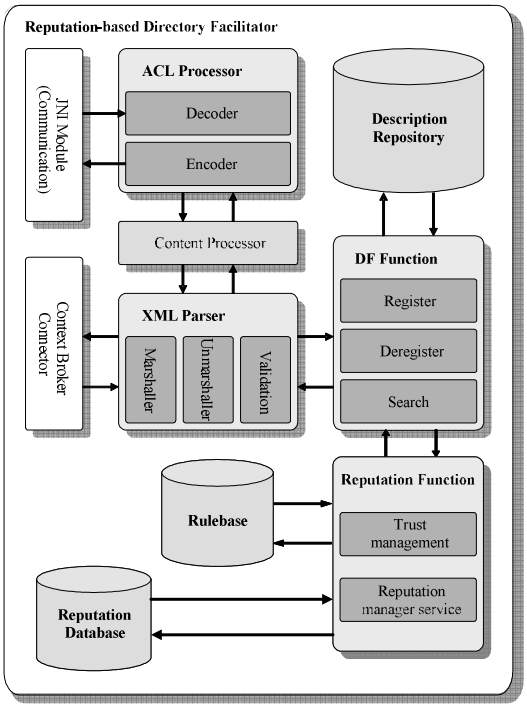

Figure 1. Architecture of Reputation-based DF

The main component is the Reputation manager service with the support of the reputation database which stores reputation data of the agents. The main goal of the reputation mechanism is to take the reputation information that is locally generated as a result of an interaction between agents, and communicate it throughout the AP (Agent Platform) to

produce a global reputation rating for the agent's service.

We illustrate the sequence diagram (in terms of percentage of successful recommendations) of a system consisting of agents with Reputation-based DF that represent general trust, not differentiated to different aspects. Successful recommendations are those positive recommendations when agents are satisfied with interactions with content providers with good reputation. If an agent gets a negative recommendation for a content provider, it will not interact with the content provider.

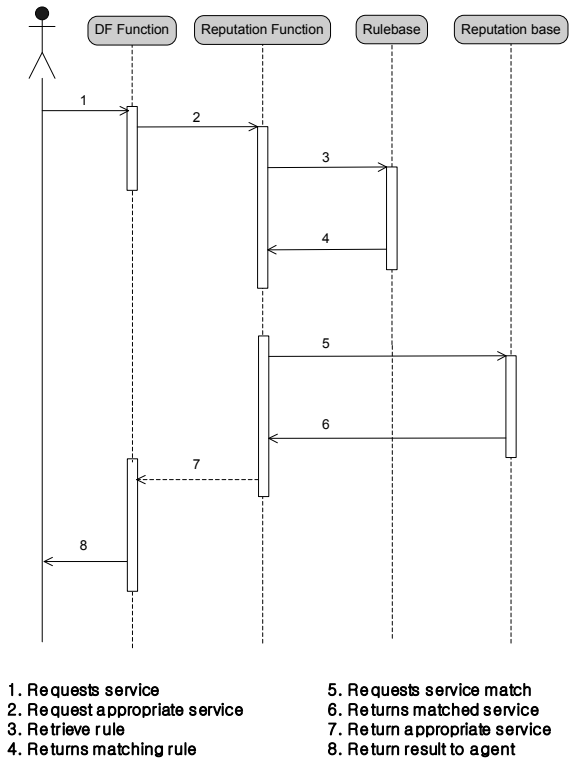

Figure 2. A sequence diagram show the interaction between the DF function and Reputation function.

4. Conclusion

In this paper, we propose a reputation-based DF to solve the problem of lack trust in multi-agent system. Our architecture represented that the system with reputation-based DF where users communicate their reputation outperform the system where users do not communicate with each other, and our approach is more robust with security under condition where existing malicious agents.

Acknowledgement

"This research is supported by Foundation of ubiquitous computing and networking project (UCN) Project, the Ministry of Knowledge Economy(MKE) 21st Century Frontier R&D Program in Korea and a result of subproject UCN 08B3-B1-10M."

References

[1] http://agtivity.com/agdef.htm

[2] Majithia, S. Ali, A.S. Rana, O.F. Walker, D.W., "Reputation-based semantic service discovery", WETICE archive Proceedings of the 13th IEEE International Workshops on Enabling Technologies, pp. 297- 302, 2004.

[3] Radu Jurca and Boi Faltings, "Eliciting Truthful Feedback for Binary Reputation Mechanisms", *IEEE/WIC/ACM International Conference on Web Intelligence (WI'04)*, September 2004.