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An Agent Based Architecture Benchmark

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Abstract

Agent based platforms provide a means for creating applications that run independently of operating system and network architecture; as a result, agents have become part of many systems and support a large number of interactions between different systems. Lately due to a shift to mobile computing paradigms, lightweight platforms, mainly oriented for resource constrained devices have emerged. To this end it is important to identify the load and to measure the performance of agent systems with appropriate benchmarks that provide details to direct future implementations.

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1. Introduction

In recent years the shift to distributed computing and the development of autonomous platforms for services provision has led to the adoption of several platforms that enable distributed communication in real time. Within the context of distributed computing efficiency is a key property. A popular framework for development of multi-agent systems that builds upon the Java programming environment is the JADE (Java Agent Development Framework) (Bellifemine et al, 2008). JADE is compliant with FIPA standards that define the rules for inter-agent communication in a multi-agent environment, and is used for the simplification of construction of multi-agent systems. A multi-agent system needs to support several requirements (Belsis et al, 2008) (Zafeiris et al, 2005):

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- Scalability (Turner et al, 2000). The number of the participating domains should be able to grow, without restricting the functionality of the system.
- Transparency. Asset identification as well as security management should be able to be performed with minimal effort on the user's behalf. In fact, the less the user involvement, the higher the user satisfaction when intelligent interfaces provide the ability to carry out the user assigned tasks within the distributed environment.
- Security management. In fact, the system should retain all the security properties for each separate domain, plus it should allow all accesses within the federated environment that will be defined as permitted by the system's administrators.
- Heterogeneity management. A main obstacle to be overcome is the fact that different organizations use different structural as well as data encoding representations; thus, overcoming this problem which in general is known as heterogeneity, demands efficient methods for effective retrieval of relevant knowledge sources.

In the following sections we will in briefly explain the design choices for an agent based application that enables remote identification of knowledge sources in a distributed environment; one other area of focus is the development of applications that focus on interaction with mobile devices. To this end our application has used special libraries for development of mobile applications. Moreover, in agent based systems performance is a key issue (Burbeck et al, 2004), (Such et al, 2007).

This work focuses on these three research directions: first it presents the principles of an application for knowledge sharing and extraction in a distributed environment using software agents; second, it explains the implementation choices in order this application to be easily accessible using mobile devices. Third it presents performance benchmarks attempting to measure the round trip times for the messages exchanged between the agents and also to measure the efficiency of the system when performing over wireless channels. The structure of the paper is as follows: Section 2 presents in brief related work. Section 3 present the architecture of the system and also gives an example usage scenario. Section 4 presents a system usage scenario; section 5 presents the setup of the experiments and the benchmark results. Section 6 concludes the paper.

2. Related work

In (Such et al, 2007) the authors perform different benchmarks measuring the response times for different scenarios; the authors check the performance of the system on N-hosts. Each benchmark is based on the performance monitoring of a multi-agent system running on different hosts. For different scenarios, the measure result was the average round trip time (RTT) of each message, i.e., the time elapsed from when a sender agent sends a message until it receives the same message sent back by a receiver agent.

In (Vrba, 2003) four different agent platforms were compared in respect to their messaging service; it turned out that JADE provides the most efficient platform compared to FIPA-OS, Jack, and ZEUS. One characteristic of this approach is that the benchmark is adjusted to the comparison of these platforms without internal details to be given; therefore the results cannot be easily extended to other platforms.

(Burbeck et al, 2004) compared the JADE platform with two other platforms. They argue about JADE's superiority due to the fact that it is built upon the Java RMI model. However apart from this claim there is no adequate evidence to support this theoretical claim.

In relevant literature (Such et al, 2007) (Burbeck et al, 2004) the JADE has been established as an extendable platform that performs adequately well in respect to other platforms. In addition it has performed well to relative benchmarks. In our work we try to focus on the performance of the JADE platform and we try to measure its capabilities over wireless environments.

In (Camacho et al, 2002) the authors request several documents with an application consisting of a number of web agents. The authors measure the number of documents requested in the unit of time for different numbers of web agents each time and varying number of documents.

In (Cortese et al, 2002) the authors present the results of scalability and performance measurements of the