

Comparisons and Evaluation Performance Criteria of Software Agents' Platforms for E-Commerce

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Abstract

The emergence of wireless telecommunications, cell phones, Internet, mobile applications, and social media contents has given rise to support mobile commerce applications. Mobile commerce applications include: marketing, advertising, customer services, payment, and supply chain management are widely transferred to this paradigm. Most mobile business users are forced to use their cell phones, to conduct business transactions in easier and efficient way.

Keywords: E-commerce; M-commerce; Mobile Agents; Software agents' platforms.

INTRODUCTION

The amount of information that is available on the Internet has largely become impossible for human who begins to visit each site on the internet and leads to analyze information and choose the best merchandise to trade. However, there is a need for trade agent that can roam sites, pass judgment, and decide where it is best to buy or sell goods on behalf of the user [1].

Agent platforms have been developed in the past few years, their actual implementation is still in its early stage, some platforms have already been abandoned whereas others continue releasing and under development [8], such platforms play a critical role in mobile commerce applications. These ensure that information retrieval is available to all practitioners in an easy accessible way and is relevant to requesting users through cell phones [10], and across social media systems [11].

Mobile commerce has launched to be used with different agent platforms, especially mobile agent platforms, different mobile commerce models have been developed to facilitate mobile business transactions using mobile devices through wireless networks [6] [4]. Several agent platforms were

suggested in mediated m-commerce and e-commerce models, as an example, the Expectation Confirmation M-Commerce Model (ECM) [7], utilizes on JADE platform, Decision Support Commerce Model (DSCM) [5], utilizes Aglet platform. However, software agents' platforms within different commerce models are always presented in a gradual manner. Specific research takes platforms as prelude and examine associated benefits and challenges in a systematic way that is still lacking [2]. This particular problem will be examined in this research.

METHODOLOGY AND APPROACH

Platforms mean differently comprehending agents in different peculiarities. The support of agents in different comprehensibility varies between independent criteria to evaluate and concrete execution [3]. The range of factors must be determined to show how to derive platform criteria dependently on platforms, in order to provide a comprehensive study of the comparison amongst agents' platforms. This paper presents set of global standards that include any platform in mobile commerce domain. Comparisons and evaluation of performance criteria of software agents' platforms tries to answer two main questions: first, what method used in comparison and evaluation of agents' platforms?, second, what are specifications that take agents' platforms as a whole and organically examine associated benefits through comparisons? [9].

Significance of this research is to distinguish agents' platforms broadly for the developer, to extract standards and explore platforms characteristics that suit for commerce applications. However, large amount of agents' platforms is now available across e-commerce and m-commerce, and there is a lack of high homogeneity. Indeed, the selection of the most appropriate or ideal platform accurate obstacles that have still faced the developers. Evaluation criteria of agents'

platforms needs to find out the choices, but unfortunately, few evaluation have existed so far.

The evaluation criteria concentrate on two evaluation types: first, qualitative evaluation which provides architecture insights and supports features of software agents' platforms. Such features include five parameters (platform properties, usability, operating ability, pragmatics, and security management), second, quantitative evaluation focus on security requirements and performance message transfer.

Overview of Agents' Platforms

In this section, we give an overview of some four agents' platforms that are widely used in commerce applications namely: JADE, Aglet, Concordia, and Voyager.

JADE Platform

Java Agent Development Framework or (JADE, Stable Release 4.5.0 / June 8, 2017) is a software environment fully implemented in Java language aiming at the development of multi agent systems that comply with FIPA standards. JADE provides many of the base classes required for agent based software development, some of them are behaviour, agent ontology, and ACL messaging. JADE is an industry-driven and currently it is the most popular platform used in industry and commerce applications [2], developing of a fuzzy-based multi-agent system for e-commerce settings using JADE. JADE is a free open source and stable multi-agent software ensuring system services and set of components for agent's management: directory facilitator, provides yellow pages services to other agents, agent management system, message transfer system, and agent communication channel.

Voyager Platform

Voyager is a multi-agent platform developed by Object Space. Latest version is 8.0, it is a simple Java based multi-agent systems used widely in e-commerce applications like negotiation, decision support commerce agents, and procurements agents. Voyager has a comprehensive set of features, including support for agent communication and agent security. However, agents in Voyager platform struggles from message sending mechanism, once an agent is launched, it is difficult to send message for other co-operating agents. One of the great advantage of Voyager that it supports both traditional client server architecture and agent based architecture.

Concordia Platform

Concordia is a full featured multi-agent framework developed by Mitsubishi Electric Information Technology Center America's (MEITCA) Horizon System Laboratory. It supports multi-agent management for accessing e-commerce information anytime, anywhere, and wireless device supporting JVM, recently, Concordia support mobile

applications that used by operating systems on Tablets and Mobile Phones supported by IOS or Android. The applications move around wireless machines running Concordia to access commerce services and database provided by other agents. Concordia system consists of JVM, a Concordia server running on a machine and a mobile agent running in the system. One of great advantage of Concordia, is that the security model support by Conduit Server. The security model support two types of protection: protection of agents in the system using encryption for agents, and protection of resources on each server using Security Manager components to manage resource protection.

Aglet Platform

Aglet SDK is a Java-based implementation multi-agent system developed by IBM Research Laboratory in Japan. The Aglet structure provides a friendly API for programming agents that used visual server manager called Tahiti. Aglet software provides an excellent framework for agent communication infrastructure for message passing mechanism. Several commerce applications were developed using aglet framework [9] using several mobile patterns for e-advertising commerce system. One of the advantages of using Aglets is the supporting of synchronous and asynchronous message passing, furthermore, the platform supports security manager for protecting agent migration on the top of Tahiti.

Comparisons and Evaluation Criteria

In this section, we highlight the research contribution in terms of performance evaluation criteria used in the aforementioned platforms and their implementation in e-commerce applications : JADE, Voyager, Concordia, and Aglet. The evaluation criteria presented focus on qualitative and quantitative evaluation. Qualitative standards set architectural insights and platform features in terms set of parameters.

Qualitative Evaluation Criteria Parameters

The following are five main parameters used to distinguish platform strengthens

Platform Properties: This illustrate Table (1), basic concepts and characteristics of platform to the developer in order to understand the scope of podium including: organization, primary domain, latest release, license, and open/closed source.

Usability: this feature Table (2), shows the extent of ability that appropriate platform used to build an application including: platform simplicity, learnability, scalability, standard compatibility, and communication mechanism.

Operating ability: This feature Table (3), takes into account platform aspects of implementation processes of agents and explore quality of platform including: performance, stability, robustness, languages, and operating system.

Pragmatics: this criteria Table (4), refers to external factors that used in the implementation of the platform including: installation, user support, popularity, and technological maturity.

Security management: this feature Table (5), shows concerns of platform security including: end-to-end security, fairness, and type of security measure.

Table 1: Qualitative Evaluation Criteria (Platform Properties)

Platform	Organization	Primary domain	Latest release	License	open
JADE	Telecom Italia	Distributed applications	Jade 4.3.1 (6/12/2013)	LGPLv2	Yes
Voyager	Voyager API Guide R02	Multi-agent based systems	Voyager 6.0.1 August 2006	commercial	No
Concordia	Concordia Association Japan	General purpose	V.3 11/1/2014	commercial	No
Aglet	IBM Tokyo Japan	General purpose multi-agent	2.0.2 Alpha release 2010	GPL	Yes

Table 2: Qualitative Evaluation Criteria (Platform Usability)

Platform	Simplicity	Learnability	Scalability	Compatibility	Communication
JADE	User friendly GUI	Easy	High	FIPA CORBA	Agent Comm. Language (ACL)
Voyager	Complicated interface	Easy	High	Not Known	Syn. WAP
Concordia	Complicated Interface	Easy	Not	Not Known	TCP/IP
Aglet	User friendly GUI	Good	Not	MASIF	Agent Transfer Protocol (ATP)

Table 3: Qualitative Evaluation Criteria (Platform Operating ability)

Platform	Performance	Stability	Robustness	Programming Language	Operating system
JADE	High	High	High	Java	JVM
Voyager	High	High	Good	Java, C++	Unix, Windows with JVM
Concordia	Good	Good	Good	Java	Windows, Linux
Aglet	Good	Good	Good	Java	Windows, Unix with JRE

Table 4: Qualitative Evaluation Criteria (Pragmatics)

Platform	Installation	User support	Popularity	Technological maturity
JADE	Command Line GUI	High	High (most Popular)	Stable release, Development status (Active)
Voyager	installer	High	High	Stable release, Development status (Active)
Concordia	installer	High	High	Stable release, Development status (Active)
Aglet	installer	High	High	Stable release, Development status (Active)

Table 5: Qualitative Evaluation Criteria (Security management)

Platform	End-to-End security	Fairness	Technological maturity
JADE	Signature and encryption support	Yes	Strong user authentication
Voyager	Authentication	Yes	Strong
Concordia	Authentication	Yes	Strong
Aglet	Weak	Yes	Weak

Quantitative Evaluation Criteria Parameters

This research focuses on presenting quantitative evaluation of B2C e-trade applications of e-commerce. For example, product discovery in e-trade scenario that one client searching for information about certain product from catalogues of several Internet stores.

The research assumes that the client requires highly customized search, which the on-line stores does not support and hence, the filtering logic is carried out along with mobile agent to each host it visits. At each shop, the mobile agent only uses the basic operation provided by the shop’s database engine. The larger part of filtering is done by the logic that the mobile agent is carried out along with it, which represents a user’s specific taste and the requirement for a given a product in the request.

Quantitative evaluation technique has two dimensions; platform performance message transfer amongst different mobile agents visiting each site; and platform security requirements in terms of confidentiality, integrity, availability, anonymity, and accountability. Our study gives a platform performance transfer of B2C mobile e-trade agents for customized search at Jordan Figure (1) .

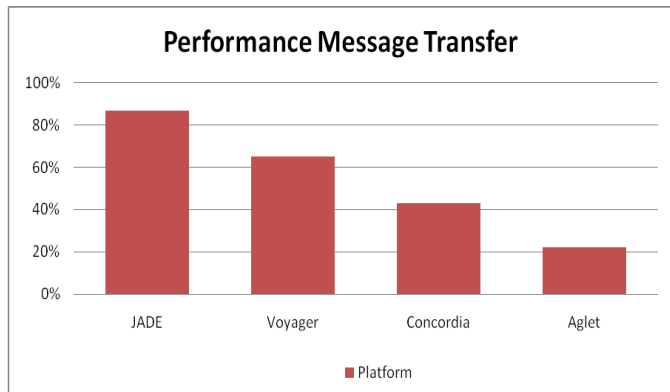


Figure 1. Platform Performance Message Transfer

The study shows that the performance of the agent platforms measure the speed of message transfer and reduce time search that elapses between the user and product request to receive results. This includes the time it takes for an agent creation, the time it takes to visit shops, and implementation of the process of liquidation of the shop catalogues and proceeds to the next desired result for host to make the final decision, choose the best deal and go back at the customer site. JADE has the least message transfer, followed by Voyager. Concordia and shows a highest message transfer and hence, Aglet is the weak performance platform.

The second dimension of security requirements is based on six criteria for assessment,

- **Criterion A.** Verification entering for platform must trace for proxy falsely repudiation an action
- **Criterion B.** Safe code interpreter should assess each code.

- **Criterion C.** Proxies should be held for their behavior by using audit track.
- **Criterion D.** Support encrypted function agents.
- **Criterion E.** Support tolerance for fault mechanisms.
- **Criterion F.** Support for access lists when authorized agents associate a transaction and authentication.

The innovative aspect is to be found in all areas of activity of the road transport enterprise. Consequently, the innovation policy shall be executed within the framework of the strategic

Table 6, indicates quantitative evaluation criteria of agents’ platforms. Figure 2, presents graphically performance evaluation criteria for agents’ platforms.

Table 6. Platform Quantitative Evaluation Criteria

Criterion	Platform	Aglet	Concordia	Voyager	JADE
Criteria A	Not Supported	Not Supported	Not Supported	Fully Supported	Fully Supported
Criteria B	Not Supported	Not Supported	Not Supported	Fully Supported	Fully Supported
Criteria C	Adequately Supported	Adequately Supported	Adequately Supported	Adequately Supported	Adequately Supported
Criteria D	Not Supported	Poorly Supported	Poorly Supported	Poorly Supported	Poorly Supported
Criteria E	Not Supported	Fully Supported	Fully Supported	Fully Supported	Fully Supported
Criteria F	Adequately Supported	Fully Supported	Fully Supported	Fully Supported	Fully Supported

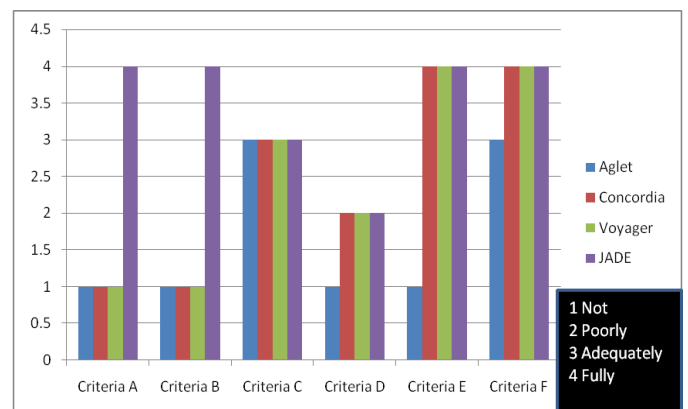


Figure 2. Platform Quantitative Evaluation Criteria

PLATFORM ANALYSIS AND DISCUSSION

Analysis of results shows that JADE fully support Criterion A, B, E, and F, JADE strengthens related to its FIPA standards tools which record platform activities under FIPA in an audit log that is protected. Voyager and Concordia are

quite acceptable platforms in running commerce applications for Criterion C, D, E, and F, while Aglet is the weakest platform for most criterion. This makes Aglet is not suitable for almost types of e-commerce applications.

CONCLUSIONS AND FUTURE WORKS

In this research, we presented two major dimensions in assessing and evaluation of four different platforms in e-commerce domain namely: JADE, Concordia, Voyager, and Aglet. We highlighted two major concerns that affect platform evaluation, qualitative evaluation which measures feature and insights of agents' platforms and quantitative evaluation with six major criteria addressing performance, environmental challenges, and assessment evaluation for e-commerce application. E-trade commerce application at Jordan is presented as a scenario to different agent platforms.

Our conclusions lead that JADE platform which based on FIPA standards supports the highest ability in performance followed by Concordia platform, followed by Voyager, and finally the least performance platform is Aglet. Several features of qualitative evaluation such as usability, operating ability, pragmatics, and security management raise optimality of JADE over other platforms. This establishment of evaluation forms the measurement objective answers to questions that have been set in this research, hence, give an easier proof to the developer to rate amongst platform when she chooses the right platform for her commerce application.

Future work encouraged researchers to take considerations into account including:

- Extensions of other platforms that provide other services in e-commerce in performance of qualitative evaluation.
- Recommendations depend more on experimental imitation that extend evaluation criteria in more specialization of other e-commerce activities.
- Reinforcement of description of agent platform services with e-commerce including other attributes like trust, reasoning, and representation formalism that allow clients to search and select most appropriate reason for their choice.

ACKNOWLEDGMENT

The authors would like to owe sincere thanks to Isra University/ Jordan for enabling and support this research. Special thanks to members of Bee-cell Electronics for Global Trading and Management Company/Jordan for their valuable insights and suggestions in finishing this research and for their inspiring and encouraging way of guiding us to a deeper understanding of this work as well as providing data and precious comments and constant feedback.

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