

Mobile Agents and SOA for Developing Virtual E-Real Estate Services

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Abstract: Principle of SOA is to create a number of loosely coupled and reusable services. Thus providing faster, cheaper and efficient service for different applications by dynamically assembled and reassembled services. In this study, work has been carried out to incorporate the applications of above two technologies collaborative environment. Further this applications are based on Mobile Agent based Collaborative SOA (MACSOA), which provides many benefits like reusable, loosely coupled, coarse grained, extensible, scalable, Secure, asynchronous and web services oriented applications. This loosely coupled, reusable component are located at web server and can be used for any other application. Service-Oriented Architecture (SOA) and Mobile Agents are 2 different highly rated technologies in the next decade. It may be assumed that the combination of these 2 technologies would provide many new applications that are not available in the past. E-Real Estate, a case study is illustrated using the proposed framework.

Key words: SOA, MACSOA, services, object, aspect, component, e-real estate

INTRODUCTION

Mobile agents work on Peer-to-Peer (P2P) communication system allow them to move about freely on a computer network looking for hosts with excess CPU cycles and allow faster and cheaper web applications. Mobile technologies are capable of providing the services that are presently unavailable for consumer and far away from small enterprise companies and service provider. Services are easy way of obtaining desired things faster. Services involve a large amount of cost both for service provider and service consumer hence it is difficult for both of them to mutually agree on contracts. Through web applications, consumer can search the services in UDDI registry to find out the desired services and the provider. Hence, it is much convenient way of obtaining desired services.

RESEARCH METHODOLOGIES AND IMPLEMENTATION

Agents and Multi Agent System (MAS) are known to provide intelligent system applications. These have been discussed in many studies in the last decade. Deugo *et al.*

(1999), Aridor *et al.* (1998) have investigated the use of patterns as a method for achieving the Interaction, Autonomy, Adaptability, Designing and Composition of agents into system. Authors have proposed that by using agent as a tool many intelligent applications can be developed. Agent role in intelligent system development are investigated in few other studies. Similarly, their use in virtual market place for buying and selling goods is studied by Chavez *et al.* (1996) and Kendall *et al.* (1996). In mobile world agent's application are also well known. Recently a few studies suggest integrating mobile agents and Service Oriented Architecture (SOA) (2003) with Distributed application like AgentOS (Mobile Agents, www.agentos.net), Yinsheng *et al.* (2003) (SOA Agents). Further, SOA have been tested with different platforms like. Net based SOA enterprise applications by Grundy *et al.* (2004). Agents, Middleware and Enterprise Applications are focus point for researchers either separately or in combination in much recent times. Combination of Web services, SOA, Distributed System and Mobile Agents and their applications can be found in Aversa *et al.* (2006), Ricci *et al.* (2006) and Fabricio *et al.* (2007). Investigation on the above study indicate a lack of Collaborative architecture and framework to combine

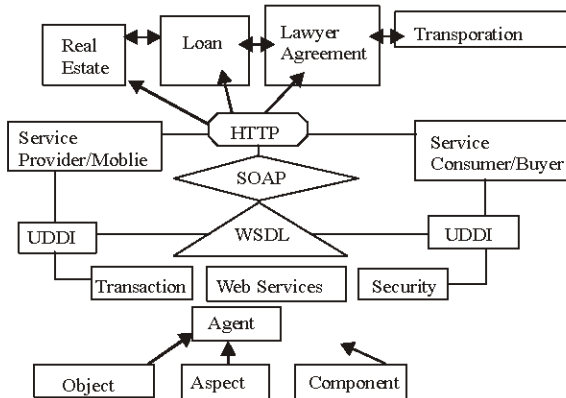


Fig 2: E-Real Estate services using Mobile Agent based Collaborative SOA (MACSOA) framework

the Object, Agent, Aspect and Component based Distributed Enterprise Application on a Mobile agent based SOA Framework. Designing and development of services oriented mobile applications i.e., MACSOA. E-Real Estate service is an enterprise application developed on this framework. A number of algorithms are proposed to first architect the collaborative framework and then integrated with Mobile Agents and SOA (MACSOA Framework). Aspect helps to manage the crosscutting behavior and establishing the coordination and communication among agents. Further Aspect Oriented Programming (AOP), aopd.net helps to further modify the application by separation of concerns (technical and business logic of the application) and easy Workflow, Knowledge/domain modeling and Web based Enterprise development, Masri (2005).

DESIGN STEPS FOR COLLABORATIVE AGENT ARCHITECTURE DESIGN

Steps for the combination: Collaborative framework is expected to provide many new features in Agent likemanagement of crosscutting behavior, modularization, distribution apart from retaining its own properties and features.

Steps for agent-component architecture stage:

- D1: Define the Kernel's AgentComponent (AC instances) interfaces component
- D2: Define the Interaction AgentComponent (AC instances) interfaces component
- D3: Define the Adaptation AgentComponent (AC instances) interfaces component.
- D4: Define the Autonomy AgentComponent (AC

instances) interfaces component.

- D5: Define the Mobility AgentComponent (AC instances) interfaces component
- D6: Define the Learning component Agent Component (AC instances) interfaces component
- D7: Define the Collaboration component Agent Component (AC instances) interfaces component

Steps for aspect-component architecture stages:

- D1: Identify the Component candidate.
- D2: Define the for each component identifying aspects
- D3: Refine the aspect indicates Aspectual Component.
- D4: Define the Provided and required aspect for each AspectualComponent.
- D5: Define the Analysis aggregated aspects.
- D6: Verify requirements found Aspectual Component

Steps for aspect-agent architecture stages:

- D1: Define the Kernel's Component.
- D2: Define the Interaction AspectualComponent.
- D3: Define the Adaptation AspectualComponent.
- D4: Define the Autonomy AspectualComponent.
- D5: Define the Mobility AspectualComponent.
- D6: Define the Learning AspectualComponent
- D7: Define the Collaboration AspectualComponent

ALGORITHMIC STEPS FOR THE BUYER AND SELLER TO FIX THE PRICE FOR A PROPERTY

There are two types of agents are involved: Property seller and buyer. Seller is the service provider and buyer is the service consumer. They both quote and negotiate on a price for the property. While other services like Loan, Lawyer Agreement and Transportation services are available for the consumer once they finalized the deal (Fig. 1).

A propertyseller agent- can find the buyer interested in a property and price is determined and agreements are discussed using the MACSOA platform:

Algorithm: 1 PropertySeller Agent

```

PS Agent ()
1: FinalValue = 0;
2: numLoop = 0;
3: marketIsOpen = yes;
4: StartAuction (PropertyPrice);
5: while (marketIsOpen) do
6: sendquotes ();
    
```

```
7: Amount= calFinalPriceofFun ();
8: if (numLoop == 0) then
9: finalPrice = Amount;
10: numLoop++;11: else
12: if (Amount!= FinalPrice) then
13: finalPrice = Amount;
14: provideNextQuoteToPB (FinalPrice);
15: numLoop++;
16: else
17: if (amount == finalPrice) then
18: quitAuction ();
19: signAgreement ();
20: end while
21: quitAuction ();
```

The Property Seller representing PS Agent provides all the information to the PropertyBuyer (PB Agent), before quoting the price for a property to the buyer. Seller and buyer can negotiate at a price and can also sign a contract. If the seller or buyer is not satisfied they can quote next price, until an agreement is finalized.

B Propertybuyer (PB agent)- responding to the propertyseller agent using the MACSOA platform:

Algorithm: (b) PropertyBuyer Agent.

```
PB Agent ()
1: PBFinalPrice = 0;
2: Quote = false;
3: while (marketIsOpen) do
4: quote = false;
5: finalPrice = waitForQuote ();
6: ok = decidelfsatisfyOrdissatisfied ();
7: if (ok == reject) then
8: provideNextQuoteToPS (FinalPrice);
9: if (ok == accept) then
10: signAgreement ();
11: quitAction ();
```

The PropertySeller representing PS (PropertySeller Agent) starts the auction and negotiations and quotes the price. PB (PropertyBuyer Agent) informs whether or not he is ready for the price. The property buyer can also quote the price, one is willing to offer. If they both agree on a particular price the agreement is signed and auction is closed. The auctions last until both are satisfied. Once both satisfied they would quit the auction system.

CONCLUSION

These applications are low cost, secure, efficient, adaptable and easily accessible, since services are registered in UDDI and can be retrieved through simple

query. The Mobile and Web applications have already available to a large masses and common people. Hence, their incorporation and coordination will further help to develop easily accessible and cheap web applications. Mobile devices can operate as service-consumers or service- providers thus enable consuming web services from mobile devices. Hence, its new fast caching trend. The mobile system works on peer-to-peer based execution environment and would allow higher benefits through SOA architecture. The proposed model is based on the existing web service and mobile technology standards in order to provide software and platform independent mobile services. It reduces the overhead on mobile devices and networks, which are resource constraints, by providing a web server, which hosts and manages all mobile services. E-Real Estate is an application, which provides service like auction, selling-buying and contracts. Present system may be further modified by integrating with new services like supply chain management, inventory system, while adding dynamic facilities and attributes like easy availability, adaptability, distribution, security, reusability and loosely coupled system for web services and application. Synergy of SOA, web services and Mobile agent are still in primarily stage. Many more work in this area is need to done. Our future work is to achieve some of the above goals for MACSOA based E-Real Estate.

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