



Expert Discovery and Interactions in Mixed Service Oriented Systems

J.Sowmya Lakshmi¹, Dr.R.V.Krishnaiah²

M.Tech Student, Dept. of CS, DRK College of Engineering and Technology, Hyderabad, AP, India¹

Principal, Department of CSE, DRK Group of Institutions, Hyderabad, Andhra Pradesh, India²

ABSTRACT -- Due to the phenomenal emergence of distributed technologies based on SOA (Service Oriented Architecture) business process integration has become a reality. Especially web services technology supports collaboration of heterogeneous systems. As such systems are complex in nature, a mixed service oriented system that comprises of services and also human beings have assumed importance. One such mixed service oriented system is the one proposed by Danial Schall et al. Their system involves two different types of users realizing benefits of the system. Each side in the market gets value based on the presence of other side. Evaluation and analysis of two sided markets in such distributed, heterogeneous system reveals the stability of two-sided markets and various kinds of coalitions in such markets.

Index Terms– *Distributed Resources, Web Services, Mixed Service Oriented System, Human Provided Services.*

1. INTRODUCTION

Web services and SOA helped in realization of mixed service oriented systems. More over the integration of web services into a BPEL (Business Process Execution Language) process that leverages automation of execution flow of the services [1]. Though distributed applications work fine, there are certain areas where human beings' presence is essential. HPS (Human Provided Services) [2] promotes flexibility in mixed service oriented systems. We consider a mixed service oriented system proposed by Danial Schall (2012) which is the combination of Software Based Services (SBS) and HPS. ExpertHits has been introduced by Denial Schall [1] that combines HPS and SBS. The distributed networking application ExpertHits is the application that has two types of users. Software engineer is a user who seeks help from another kind of user namely expert. Experts are human beings that have adequate knowledge in various subjects of IT. The software engineers get benefited from the presence of experts that are associated with the network while the experts get benighted by the distributed web based enterprise level application. Trust model has been used in the ExpertHits, as it helps in determining right expert for the given query [6], [7], [8].

Further mode, the ExpertHITS is the system on which the concepts of hubs and authorities are used. Score is provided for hubs and also authorities. Hubs are the experts who know other experts and delegate the query given by user. In the same fashion, authority is an expert who really solved the given problem. A skill model and a trust model are used in the system. They are used to improve effectiveness of the

system. The system which is having web services and also human beings working together is also having two sided markets. Two sided markets come into existence where there are two kinds of users involved in the system [40]. In the ExpertHits system, the two users representing two networks are software engineer (user) and expert [41]. Evolution of such two sided markets can bring about facts pertaining to their relationships and also the gaining of benefits due to the presence of other side over network. Therefore we propose improvement of ExpertHITS that ensures the evaluation of two sided markets. The proposed system also provides a new algorithm known as "MarketEvaluation" algorithm. This algorithm is meant for evaluating two sided markets present in the distributed system discussed above. Its discovery includes calculation of same side and cross side effects when the number of users increases or decrease in the system. The rest of the paper describes related work and also implementation details.

2. RELATED WORK

Service orientation is not only in web services but also in collaborations of human beings. There has been research going on the standards that govern the mixed service oriented systems. Such standards are Bpel4People [4] and WS-HT [17] were developed in order to address the need for human interactions in mixed service based systems [19]. The aim of the mixed service oriented systems is to make a distributed system robust, flexible and model a real world solution [3]. The applications that run over web allow users to share their views and experiences are known as task-based



platforms [21]. Thus users can help others of same kind of different kind altogether [22]. Expertise of users was known by HITS [12] and Page Rank [25] in order to envisage the expertise of users. In business collaborations trust also plays an important role. Recently [29] [30] [31] introduced trust management framework in systems that use SOA. Though plenty of research articles came into existence for the last many years, addressing of fundamental research questions was not prompted. As the proposed system involved both mixed service oriented system with mechanisms to evaluate two sided markets.

Rochet and Tirole [14]* did research on economic study of two-sided markets. Later Weyl [16] *extended this work. Between platforms and suppliers a game was presented by Lee [9]* in the form of two sided markets. The research reveals that competition can lead to sub-optimal equilibrium. Vertical integration of market shares is another research done in the similar lines [10]*. When new user is added to an existing network some value gets added to network users, this is known as “network effect”. Robert Metcalfe [11]* in 1995 introduced a concept that is with number of consumers, product pricing is increased. Tim Berners Lee, the author of WWW also specified that the structured data on the web will generate a lot of new value. In [2]*, [7]* preferential attachment was described in social networks and in [7]* social networking technology is described. The proposed system is a mixed service oriented system that comprises of web based application which can access various kinds of web services and also the implementation of two sided markets and evaluation of the same.

3. PROPOSED MODEL

3.1 Two Sided Markets

- ▶ Two-sided markets arise when two different types of users may realize gains by interacting with one another through one or more platforms or mediators.
- ▶ A two-sided market is a system of connections between three types of agents: users of the first type (software developers, questioners), users of the second type (authorities, answerers) and intermediaries (hubs, delegators)
- ▶ **Cross-side network effects:** if a new software developer (blue user) joins some platform, then it makes the platform more attractive for the authority users, and vice versa.
- ▶ **Same-side network effect:** if the number of authority (green user) users grows, then it can add value to the platform through shared reviews or shared access tools. Note however that in some cases there might be a negative

same-side network effect: the more such users in a platform, the higher is competition.

3.2 Market State and Evaluation

The two sided markets have three types of users and two types of users. Interactions are among the two types of users. As per the above descriptions of terms, the market state at any given time “t” is computed using the following equation.

$$M(t) = (B_1(t), \dots, B_k(t), G_1(t), \dots, G_k(t))$$

And the following formula is used to evaluation .

$$M(t + 1) = F(M(t)) \text{ where } F \text{ is a stochastic function.}$$

The essence of the algorithm is described in the following listing.

1.	If(new user)
1.	calculate probability of same side and cross side effects
2.	Else if(remove user)
1.	calculate probability of same side and cross side effects
3.	Else if(new expert)
1.	calculate probability of same side and cross side effects
4.	Else if(remove expert)
1.	calculate probability of same side and cross side effects
5.	Update the effects database

Listing 1: Shows Market Evaluation Algorithm

As can be seen in the above listing it is evident that the same side market value decreases when new user is added while the cross side benefits are increased. When an existing user is removed same side effect is positive while the cross side effect is negative. In the same fashion, the benefits of same side are decreased when new expert is added to the network and cross side effect is increased. When an expert is removed from network, the same side effect is positive while the cross side is negative.

4. IMPLEMENTATION

The implementation environment is a PC with Windows 7 as OS and NetBeans as IDE (Integrated Development Environment). JDK 1.6 is the JSE (Java Standard Edition) and Oracle 10G as backend. The front end is built using Servlets and JSP pages while services are implemented using web services technology. The web application provides web user interface while the servlets in turn interact with services. The architecture is distributed n-tier architecture. The implemented system has two users. User and Admin are the two types of users. User represents a software engineer who can give queries pertaining to their work to experts. Expert discovery is made before an expert



is selected. It also makes use of skill matching algorithms to match skills.

5. RESULTS

The results of two sided market effects are presented graphically in this section. The graphs are the result of the experiments made on the live enterprise application. The operations such as adding new user, deleting an existing user, adding new expert, deleting new expert. From the user perspective, assuming that expert count remains same for some time, the results of all experiments are shown in figure 1.

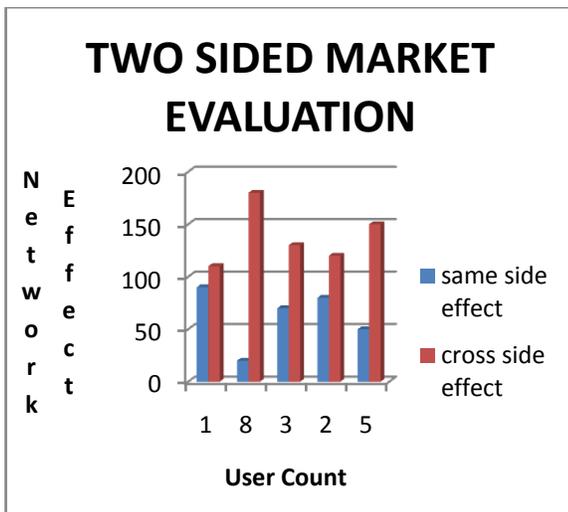


Fig. 1: Shows two – sided markets evaluation from users’ perspective

As can be seen in the above figure, as user count increases, same side effect is reduced and the cross side effect increased. While making experiments a value such as weight is considered for each network. The weight is manipulated when new user is added or removed. Same case with experts. The following figure shows network effects from experts’ perspective.

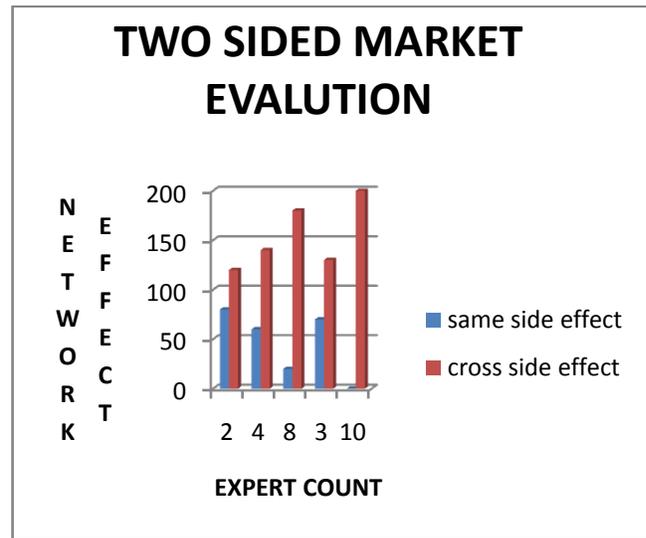


Fig. 2: Shows two – sided markets evaluation from experts’ perspective

As can be seen in the above figure, as expert count increases, same side effect is reduced and the cross side effect increased. While making experiments a value such as weight is considered for each network. The weight is manipulated when expert user is added or removed. Same case with experts. The following figure shows network effects from experts’ perspective.

6. CONCLUSION

Service Oriented System with Human interactions (Mixed Service Oriented System) has become common in distributed computing. The aim of this project is to evaluate two sided markets. However, ExpertHITS has been enhanced for this purpose. It already has users and experts in an enterprise application. User’s queries are answered by experts and also some software services. This mix of software services and human interaction makes this very flexible. The two sided market evaluation has been done on the enterprise application. The results revealed that the network benefits are affected by the presence of cross side users. The possible future work for this project is studying the stability of market evaluation under various models of noise.

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BIOGRAPHY



J. Sowmya Lakshmi has completed B.Tech (C.S.E) from St. Martins College and pursuing M.Tech (C.S) in DRK College of Engg and Technology, JNTUH, Hyderabad, Andhra Pradesh, India. Her main research interest includes Mobile Communications & Computer Networks.



Dr. R. V. Krishnaiah, M.Tech (EIE), MTech (CSE), Ph.D, MIE, MIETE, MISTE Principal & DRK Institute of Science and Technology, Hyderabad. His main research interests include Computer networks, Data mining, Software Engineering, network protection and security control. He has various publications and presentations in various national and international journals.