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Social Networks Based Model for Leveraging Infrastructure Resource Allocation in Cloud Computing

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ABSTRACT: Social networking has become a popular platform for people of all walks of life to communicate instantly. At the same time cloud computing technology has emerged as a new computing model in 21st century that has its impact on the individuals and businesses in the real world. Cloud computing became affordable as it is on top of virtualization. Resource allocation is one of the important aspects in the success of cloud computing. Optimal allocation of resources can make it robust and serve its users efficiently. Exploring social networks for optimal infrastructure resource allocation is a novel idea and is challenging problem to be addressed. Recently Caton et al. proposed social compute cloud which makes use of friend relationships in social networking for resource allocation. In similar fashion, in this paper we proposed and implemented social computing based resource allocation with user preferences besides using clustering for optimal optimizing the task. We also proposed an algorithm for server side resource optimization. We built a prototype application that demonstrates the proof of concept.

KEYWORDS: Cloud computing, social networks, social cloud computing, resource allocation

I .INTRODUCTION

Cloud computing is an emerging technology of new model in computing arena which realizes the dream of commoditizing computing resources in pay per use fashion. As envisaged in 1960s, the cloud computing became a reality now which helps individuals and organizations to gain access to huge amount of computing resources without the need for capital investment. This lets a common man or small organization to leverage businesses to higher level by utilizing cloud services. The conceptual overview of cloud computing is as shown in Figure 1. The cloud is dynamically scalable and can provide various kinds of services in pay as you use fashion with affordable pricing.

As can be seen in Figure 2, it is evident that Google Apps, Salesforce.com are examples for software as a service. This service provides software that can be used by cloud users in pay per use fashion. For instance Gmail is given free up to 15 GB. Afterwards, the users of Gmail are charged in pay per use fashion (Vecchiola et al., 2009). This service provided by the cloud focuses on providing application development platforms for cloud computing applications. The best examples for this kind of service include Microsoft Azure, Aneka and Google App Engine. These platforms help developers build applications that run in cloud (Vecchiola et al., 2009). This service is very important for cloud as other services depend on this. The data centres, storage facilities, grids, clusters come under this category. The technologies or products that are associated with this service include Open Nebula, Mosso, Eucalyptus, Amazon S3, EC3, VM management and deployment and virtualization (Vecchiola et al., 2009).

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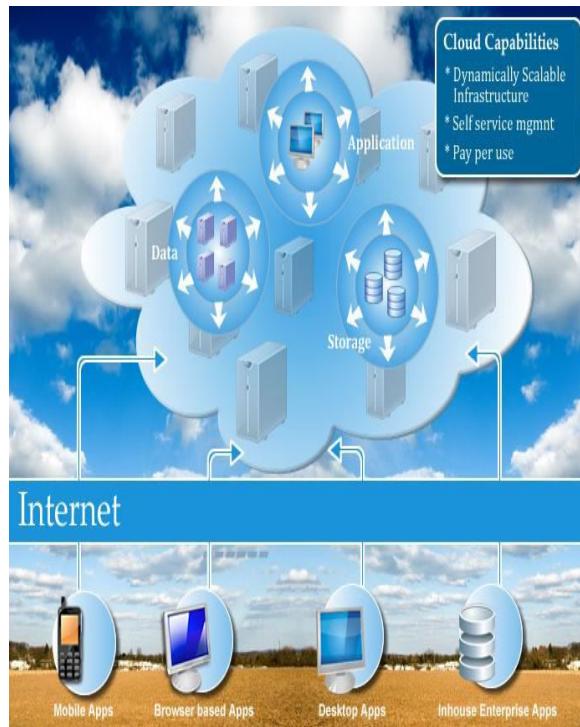


Figure 1 – Overview of cloud computing (Torry Harris)

In this paper we explore the optimization of cloud resource allocation through social networks. Towards this end we built a mechanism that takes care of the resource allocation and optimization through social networking. The remainder of the paper is structured as follows. Section 2 reviews literature. Section 3 provides details of the proposed system. Section 4 presents experimental results while section 5 concludes the paper and provides recommendations for future work.

II.RELATED WORKS

As the social networking platforms became popular and they are widely used in the real world, social network structures came into existence as explored in [1], [2], [3], [4] and [5]. Social networks have storage systems and they are also associated with cloud computing. Social cloud model was proposed by Ali et al. [6] that makes use of virtual machines provided by the cloud platform Amazon EC2. The allocation of resources through social computing has its own advantages like efficiency and ease of doing. Another social cloud kind of solution was given by Mohaisen et al. [7] where the design and implementation are explored. Later in [8] the concept of social cloud was presented. However, that work was limited to conceptualization of the social cloud. Many cloud storage solutions came into existence that makes use of social networks [9], [10]. For instance drop box, F2Box are examples. May studies such as [11], [12] and [13] focused on different types of incentives for participating social cloud. In this paper we threw light into this further to know how social networking and cloud concepts can in target for resource allocation.

Opportunistic cloud computing services [14] were introduced in [14] where enterprise social networks are used for governing platform for cloud computing. In the same fashion, similar concepts were applied in Diaspora, 4 and My3 explored to allocate resources through social networking [15]. In [16] security implications were discussed about the resource allocations through social cloud concept. They threw light on security issues and counter measures and believed that there were possibilities of threats in social cloud computing. In this paper we proposed a framework that

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can be used for social cloud implementation for dynamic resource allocation by leveraging existing social networks. The security implications are left for future work.

III.PROPOSED SYSTEM

Based on the concepts provided by Caton et al. in social cloud, our proposed architecture is shown in Figure 2. There are three modules in the proposed system. They are known as social network, social compute cloud, and social clearing house. The social clearing house requires access to a user's Facebook profile. To do so, we have created a Facebook application for the social clearing house that requests access to profile information, friends and friend lists of registered users. The Facebook application is integrated with the clearing house through the Django social auth plug-in which, when congaed with a Facebook application, allows users to associate their Seattle account with their Facebook account. Authentication with Facebook uses the OAuth2 protocol to obtain an access token that allows the requesting application. The clearing house stores the list of friends for each user in an application database and periodically refreshes this information

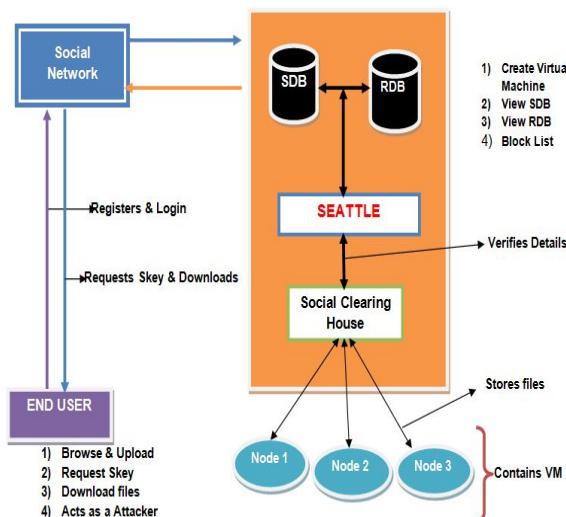


Figure 2 – Proposed architecture for dynamic resource allocation through social network

A social compute cloud is designed to enable access to elastic compute capabilities provided through a cloud fabric constructed over resources contributed by socially connected peers. A social cloud is a form of community cloud. The resources are owned, provided and consumed by members of a social community. Building upon Seattle we leverage the same base implementation for account creation and registration processes donation infrastructure, and resource acquisition mechanisms. The deployed social clearing house leverages social information derived from users' Facebook profiles and relationships. A service that enables users to define preferences and we have developed several new allocation mechanisms that utilize socially aware preference matching algorithms

In addition to this, the server side resource allocation is made using the following algorithm for both side optimizations.

Algorithm : Dynamic Resource Allocation Algorithm

Inputs : Available Resources Allocation

Outputs : Achieve Overload Avoidance in an over-committed cloud

Initially Available Resources are allocated to cloud clients based on their demand.

Capacity of physical machine P;

Initialization:

Assign definite number of VMs to each physical machine;

Cloud is over-committed if 90% of its capacity P is used

Checking Free Capacity of all PMs

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First we calculate the capacities of PMs after resource allocation to VMs is done

Observing over-commitment of cloud

for $h = 1$ to N_{pm} do

IF VM ' h ' capacity requirement is more than its allocated capacity THEN

report machine h has over-commitment issue;

OverList = OverList \cup h ;

Avoiding over-commitment problem

This can be done either extending over loaded VM capacity or by migrating the VM to another physical machine having sufficient resources.

CASE 1: VM CAPACITY EXTENSION

When VM gets overloaded

First Check PM free memory

IF PM has available free memory THEN

Allocate the free memory to overloaded VM

Overloaded VM capacity= original VM capacity U free memory of PM

END

IF Free memory of PM is not available THEN

Check for unused memory of other VMs running on the Physical machine

IF available, then reallocate the unused memory to overloaded VM

Overloaded VM capacity= original VM capacity U unused memory of other VM on PM

END IF

END

IF above two cases fails THEN VMs are exchanged

Find best VM to exchange

Check any VM on other PM is ready to exchange

IF VM on other PM is ready to exchange with overloaded VM THEN

X = exchange(overloaded VM, VM on other VM)

Two VMs are successfully Exchanged

END IF

END

CASE 2: LIVE VM MIGRATION

IF capacity extension fails THEN

Prepare OverList with overloaded VMs

for each VM in OverList do

check overload comparing each other

Identify more over loaded VM to migrate

Identify other PM with available resources

Use Sequence migration if possible

END IF

END

As shown in the above listing, the server side resource allocation algorithm is based on two concepts such as VM live migration and VM capacity extension. The algorithm is self explanatory and is responsible for optimizing resource allocation.

IV. PROTOTYPE IMPLEMENTATION

We built an application that demonstrates the proposed system in this paper. The application has been built in Java platform. The application is user friendly and demonstrates the functions of the modules presented in this paper. The social networking UI is as shown in Figure 3.

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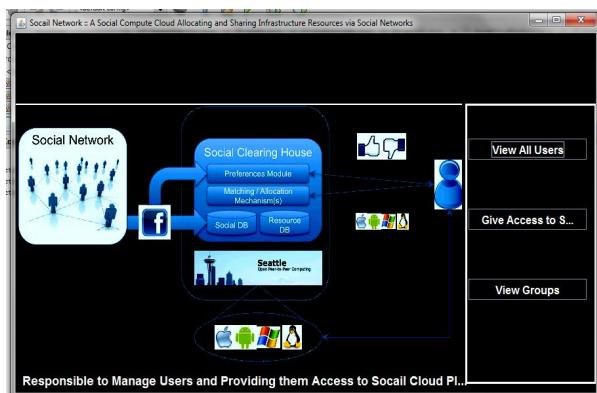


Figure 3 – UI for social network

The social networking module allows managing users and groups besides giving him privileges to access to social cloud platform. This will help users of social networks to gain access to cloud.

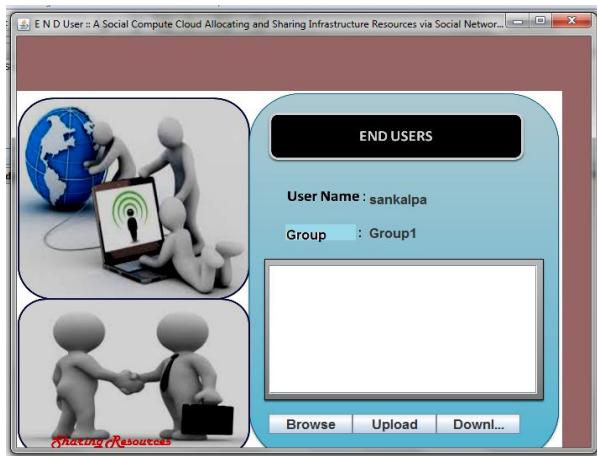


Figure 4 – End user UI

End users can gain access to social cloud after due authentication. The users are grouped together so as to make administration easy. The social cloud computing and its resource allocations through social networks helped to optimize resources. Besides this the algorithm presented in this paper optimizes resource allocation at server side as well.

V. EXPERIMENTAL RESULTS

Experiments are made in term of number of ranked users and the time taken for the proposed algorithm. The experiments are made with custom simulator building using Java platform. The results are compared with different algorithms.

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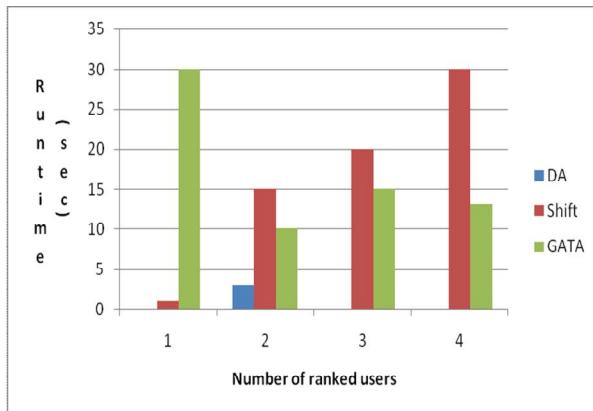


Figure 3 – Number of ranked users vs. runtime

As can be seen in Figure 3, it is evident that the number of ranked users is represented by horizontal axis while the vertical axis represents the runtime required. The results reveal that the proposed system shows better performance.

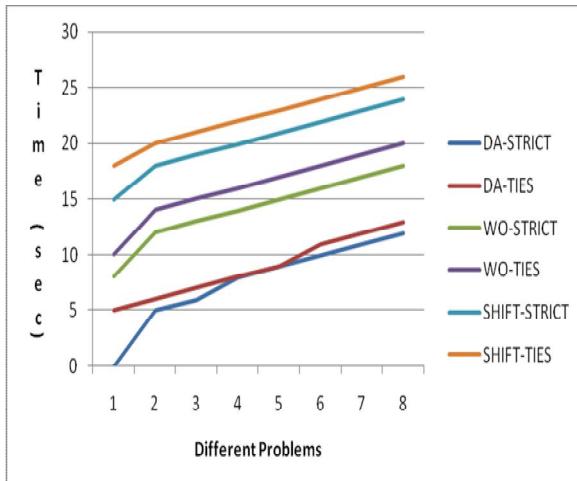


Figure 4 – Different problems vs. runtime

As can be seen in Figure 4, it is evident that the different problems are represented by horizontal axis while the vertical axis represents the runtime required. The results reveal that the proposed system shows better performance.

VI. CONCLUSION AND FUTURE WORK

In this paper we studied social computing phenomena to leverage resource allocation in cloud computing. A new model of social compute cloud is presented and implemented. Social aware resource allocation with user preferences is given paramount importance. More over data mining algorithms like clustering is used in order to improve the allocation performance. We implemented different modules like social networking, social compute cloud and social clearing centre. Social networking is the phenomenon which allows users across the globe to have a virtual platform for instant communication. The social compute cloud is responsible to allocate resources optimally through social networking. The end users of social networking are able to get resources of cloud to be allocated. The social clearing house is responsible to properly allocation resources dynamically. We built a prototype application using Java platform to demonstrate the proof of concept. We also proposed an algorithm for service side resource optimization. The empirical results revealed that the proposed application is able to allocate resources optimally based on user preferences. This

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research can be extended further by investigating dynamic resource allocation through social compute cloud without security vulnerabilities.

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