Global Journal of Computer Science and Technology: B
Cloud and Distributed
Volume 15 Issue 4 Version 1.0 Year 2015
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

A Dynamic Resource Allocation based on Multi Attributes Scoring in Collaborative Cloud Computing

By Pavan Kumar V, Anitha N & Anirban Basu
EPCET, India

Abstract- Collaborative cloud computing involves providing cloud services on globally distributed resources belonging to different organizations in a cooperative manner. Resource management and allocation in Collaborative Cloud is challenging because of the heterogeneity of the resources. The other challenge is guaranteeing the Quality of Service (QOS) and availability of these resources. Users' resource demands have to be managed properly to ensure acceptable QOS. In this paper, we propose a method for effective management and allocation of resources using machine learning and using multi attribute tuning. The method has been simulated in cloud-sim as well as implemented on Amazon work space and results show that the proposed method performs better than reputation based algorithms.

GJCST-B Classification : C.1.4 H.3.4

Strictly as per the compliance and regulations of:

A Dynamic Resource Allocation Based on Multi Attributes Scoring in Collaborative Cloud Computing

Pavan Kumar V [α], Anitha N [σ] & Anirban Basu [ρ]

Abstract- Collaborative cloud computing involves providing cloud services on globally distributed resources belonging to different organizations in a cooperative manner. Resource management and allocation in Collaborative Cloud is challenging because of the heterogeneity of the resources. The other challenge is guaranteeing the Quality of Service (QOS) and availability of these resources. Users' resource demands have to be managed properly to ensure acceptable QOS. In this paper, we propose a method for effective management and allocation of resources using machine learning and using multi attribute tuning. The method has been simulated in cloud-sim as well as implemented on Amazon work space and results show that the proposed method performs better than reputation based algorithms.

I. Introduction

Today many organizations are moving their application to a cloud computing platform due to fluctuation in demand for resources. Sometimes the demand for the resources may be difficult to be satisfied by single cloud. If resources provided by a single cloud are not sufficient for the application then collaborative cloud is to be used. Collaborative Cloud involves distributing the application among multiple Cloud services available.

The physical resources are interconnected using the collaborative cloud computing (CCC) which allows the sharing of resources between different clouds. At the same time provides a tremendous amount of virtual resources to customers. For the cloud customers, this virtual organization is visible. When a customer's demands are not met by a single cloud, other cloud is requested to satisfy the needs of a customer. collaborative cloud computing operates in a environment where the number of resources range in thousands or millions, and the resources are spread across the world and dynamic nature is inherited into it to allow entities to leave or enter the system as the availability or utilization of the resources are changing constantly.

Some of the challenges that are faced in using the collaborative cloud computing are:

1. Trustworthy resources are not efficiently located.
2. Complexity in selecting the resources from the options located.
3. Preventing any node from being overloaded while making sure that all the resources are used to the maximum.

To address the above said challenges, reputation based algorithms are used.

The previous algorithm [1], [2], [3] have ignored heterogeneity nature of the resources, instead all the node are assigned a single reputation value. The reputation of the node should not be same and this should be different for different resources typed nodes. For instance let's consider that general physician will give good advice on health but not necessarily give good advice on finance. Similarly a single node may be good in handling the computing services but not so good when it comes to storage service. Hence the entire previous algorithms which were used for assigning the reputation for nodes are not effective in selecting the trustworthy resources by an individual.

The previous algorithm will only consider one of the QOS user demands, like the security or the efficiency. If there are a number of servers or resources available, the policy based on the efficiency will only consider the node which has the maximum resources, whereas the policy based o the security will only consider the nodes which has the highest reputation only. The security based selecting will lead to overloading o the nodes while the efficiency based selection will lead to lower success rate of the service.

Hence when the reputation based deployments are uncoordinated, it will result in a behavior which is contradictory and the effectiveness of the both are significantly affected and hence overall performance is also affected. Hence focusing on a single QOS has its own kind of challenges.

a) How the different demands of the QOS such as the availability, efficiency and reputation of resources can be considered for resources selection.
b) How a node can control actively the resource supply and reputation control while making sure that it is not being overloaded without compromising the profit and gain reputation.

Author α σ ρ : East Point College of Engineering and Technology, Bengaluru, Karnataka, India. e-mails: pavankumar0330@gmail.com, anitha_nmurthy@yahoo.com, abasu@pqrsoftware.com.

Power-Trust is based on the trust value, where the either initial value is same and initially allocates the job to some node. If response time is met with the execution time then reputation value is increased, if it is not met the execution time then response time is decreased. By continually choosing most reputed hubs, affecting routines neglect directed towards endeavor hub reputation within resource variety facing completely as well as moderately uses resources in effective framework as well as to reconciled clients various Quality of Service requisitions successful

A node cannot reflect its reputation properly for its individual resources type when there is a single reputation value assigned to the nodes. If nodes with the highest reputation are being selected, this will affect the way the node are utilized or the way the node are selected based on their reputation and also satisfy the different QOS needs of a customer. So we have to better understand the interdependencies among reputation management and resources management.

As there are many issues on single QOS reputation allocation for CCC, we have proposed a effective resource allocation which is based on multi QOS scoring where the resource selection is multi-faceted and also compared with power trust method.

II. Related Work

Haiying Shen [4], have proposed a platform for efficient and trustworthy resource sharing in CCC, where an cloud resources are globally scattered that are belonging to different organization or entities that are collectively utilized in a cooperative way to offer services. For the successful deployment of the CCC, the problems of resource and reputation management must be jointly addressed. Resource and reputation management methods that are discussed earlier are not sufficiently effective or efficient. The methods fail to exploit the reputation of node by considering the highest reputation values during the resource selection and to meet the QOS demands of the clients. Hence they proposed a new CCC platform called Harmony, that integrates the reputation and resource management in an harmonious manner. It has 3 innovations: multi QOS oriented resource selection, reputation management/ integrated multi-faceted resource, reputation control/price assisted resource. The existing Resource and reputation management are showed in terms of effectiveness, efficiency and QOS in Harmony by performing simulation and trace driven experiments in the real-world Planet Lab.

J. Li, B. Li [5] has proposed a cloud virtual organization for the multiple clouds collaboration. The interest for scalable resources in a few applications has been expanding quickly. Numerous researches are going ahead to make one environment connecting various clouds for scalable computing abilities or for completely using inactive resources. By distinguishing and comprehension the interdependencies between Resources, Preference of clients and User Preference Resource Selection in Utility based, a Collaborative Cloud Computing stage has introduced, which concentrate on Cloud Resources, Cloud Service Providers SLS's, User Preferences, and use of the clients. It can accomplish improved proficient management of resources and user fulfillment between distributed resources in Collaborative Cloud Computing. This technique gives a situation to point out its required resources, Resources capability or ability, User's Requirements and also finds the available of the resources. At that time the cloud users can be capable to be familiar with each Cloud Resources and all insights regarding the Cloud capability, so that cloud users can pick viable cloud platform. Moreover, this environment is scalable to the cloud clients.

In paper [6] , as cloud computing turn out to be broadly sent, one of the difficulties confronted includes capacity through orchestra, an extremely complex arrangement of subordinate systems (storage, network resource and compute) that compass vast geographic ranges serving assorted customers. To facilitate procedure, individually prompt COPE (Cloud Orchestration Policy Engine), a circulated platform that permits cloud suppliers to behave informative robotized cloud resource orchestration has been proposed. In COPE, cloud suppliers indicate system-wide imperatives and objectives utilizing COPE log, a decisive strategy dialect adopted towards determining distributed constraint expansions. COPE catch approach details and cloud framework defines as information together with afterwards enhance network resource allocations, compute and storage inside of the cloud like supplier operational goals and client SLA's can be preferably met. Individually depict future mix with a cloud orchestration stage, and instant beginning of estimating effects that exhibit the possibility of COPE utilizing creation follows from expansive facilitating organization in US. They additional examined orchestration situation, includes topographically dispersed data centers.

In Cloud Resource Orchestration [7] the trust and security have kept organizations from completely tolerating cloud platforms. To preserve clouds, suppliers should primarily secure virtualized data-centre resources, maintain client protection, and save information uprightness. The writers propose utilizing a trust-overlay set-up in excess of numerous information centers for execution of reputation scheme for building a belief betwixt service contractors and information proprietors. Information coloring and spreadsheet watermarking procedures secure pooled information items and enormously dispersed coding modules. These approach shelter the multi-way confirmations, allow solitary sign-in cloud, as well as fix right to use

manage delicate information in mutually open and confidential clouds.

F.M.Fernandez [8] proposes virtual defense and Reputation Based Trust Management for CCC. The escalating ubiquity of cloud computing as appealing distinct option through fantastic statistics handling systems have been increased significance about its right along with persistent operation even in the vicinity of deficient segments. Present an inventive framework level standard perspective making along with overseeing failure acceptance in Clouds. An exhaustive high-level access via shade the exertion information of the error acceptance methods to app designers and clients by ways of committed utility panels. Specifically, the service panels permits client to determine and apply the fancied level of error acceptance, and does not oblige learning about the error acceptance methods that are accessible in the imagined Cloud and their executions. Making and overseeing fault tolerance in Cloud environment that the user does not oblige information about the adoption of internal failure systems. The fundamental point of the fragmentation idea is decreasing time delay and giving security to cloud server.

The Reputation systems proposed in [9] known as Trust guard as became famous in evaluating the dependability and foreseeing the prospect conduct of hubs in an expansive-scale dispersed system where hubs may execute each other without former experience or knowledge. Major difficulties in distributed reputation management are to comprehend vulnerabilities and also create instruments to reduce the possible harms to a framework by vindictive nodes. In the document they recognize three susceptibility that are adverse in respect to scattered reputation management and recommend Trust Guard – a protection system for giving an exceedingly trustworthy and efficient reputation system.

To start with, a responsible trust model has been provided and an arrangement of official strategies to hold strategic malevolent hubs that consistently transforms their behavior to increase iniquitous benefits at frameworks. Next in order, an exchange based reputation system must adapt to the susceptibility that malevolent hubs may abuse the framework by overflowing inputs with false exchanges. Last, yet but not slightest, individuals analyze significance of sifting through deceitful criticisms meanwhile calculating reputation-based faith of node, comprising the inputs documented that has malevolent nodes via plot. The trials exhibits that, contrasting along with present reputation systems, the system is extremely reliable and successful in differing malevolent nodes regards to planned wavering conduct, deluging malicious inputs along forged exchanges, and exploitative criticisms.

III. Overview of the Proposed Solution

Our solution for resource allocation is based on multi attribute based QOS scoring. In our approach we allocate QOS score to the resources based on following attributes

1. Distance to the resources from user site
2. Reputation of the resource
3. Task completion time
4. Task completion ratio
5. Load at the resource

Based on all these attributes, we train a neural network QOS scoring system and use it to score the resources and select the resources with best score for user task allocation. We refer to this algorithm as Multi Attribute QOS Scoring (MAQS).

IV. Proposed Solution

Our proposed solution for dynamic resource allocation consists of 3 parts

1. Training
2. Data collection
3. Allocation

a) Training

In Training Stage we train a multi layer feed forward neural network which takes the five attributes as input and provides QOS as output.

1. Price
2. Reputation
3. Efficiency
4. Distance

Training is periodically conducted to learn the inherent behavior in the system.

b) Data Collection

In data collection stage, we collect data from all the nodes scattered across periodically.

Each node participating in Collaborative cloud have probe installed and the probe collects the statistics and reports to central manager. The central manager maintains the periodic heartbeat with the nodes in collaborative cloud to know the availability and based on it, reputation is calculated.

c) Allocation

User tasks are allocated with resources based on the multi QOS parameter. Whenever user task arrives we calculate the QOS score for the node by providing the data collection from node to neural network. The best QOS score node is selected and the task is allocated.

V. System Implementation

We implemented the system with following modular architecture as shown in figure 1.

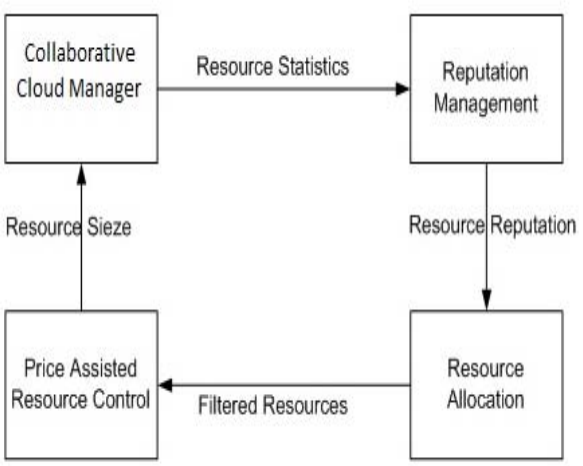

Figure 1 : System Architecture

Coordinated Cloud Manager: This module handles the registration / Heart beat of the coordinated clouds distributed geographically.

Reputation Manager: This module collects statistics report from the coordinated cloud and uses it to calculate the reputation score.

Resource Selection: This module selects the resources based on the reputation score and QOS required for the task to be executed.

Price Assisted Resource Control: To avoid overload at reputed nodes, pricing assisted control is done to select the non overloaded resource for job execution.

The system is implemented on the top of cloud sim simulator.

We have used 3 layer neural networks with 5 input neurons for each of five inputs {w1, w2, w3, w4, w5} as shown below:

w1: Distance to the resources from user site

w2: Reputation of the resource
w3: Task completion time
w4: Task completion ratio
w5: Load at the resource

All these parameters are normalized to the value of 0 to 1 before giving it to neural network. The neural network will have 1 output neuron for the QOS score of total 4 output neuron n1, n2, n3, n4 for each score as given below:

n1: Price
n2: Reputation
n3: Efficiency
n4: Distance

We have used back propagation algorithm with LMS (Least mean Square) at learning rate of 0.9 and error of 0.001 with maximum of 100 iterations.

This output is given to the Price Assisted Resource Control which is the next stage of the process.

VI. Performance Analysis

We implemented the proposed algorithm for resource allocation in cloud-sim simulator.

We measured the average success rate and the average completion time between the reputation based and the proposed MAQS.

The average success rate for the varied number of requests rate is measured as shown in figure 2 and from this we see that the success rate in the proposed MAQS system is high.

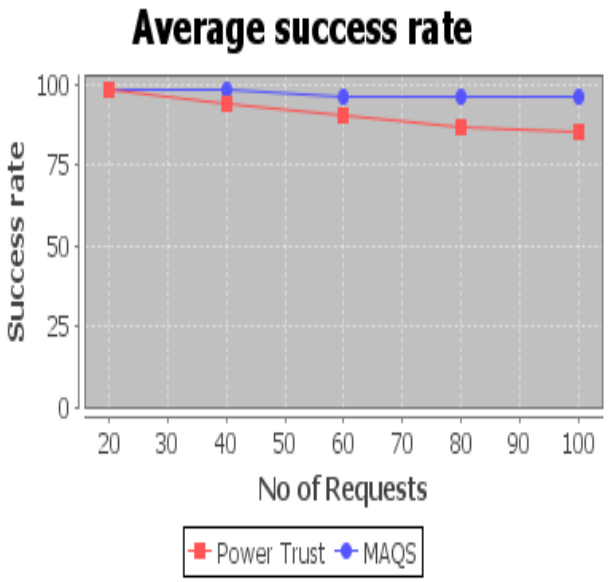

Figure 2 : Graph of success rate

The average completion time for the varied number of requests rate is measured as in figure 3 and from this we see that the completion time is less in proposed MAQS when compared to reputation based systems.

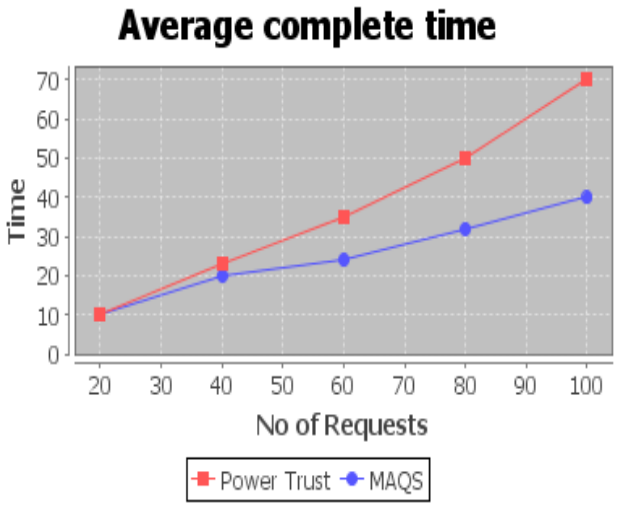

Figure 3 : Graph of success rate

We have also implemented on the Amazon work space and found that the simulated values are same as that of the Amazon work space. The figure 4 depicts the same.

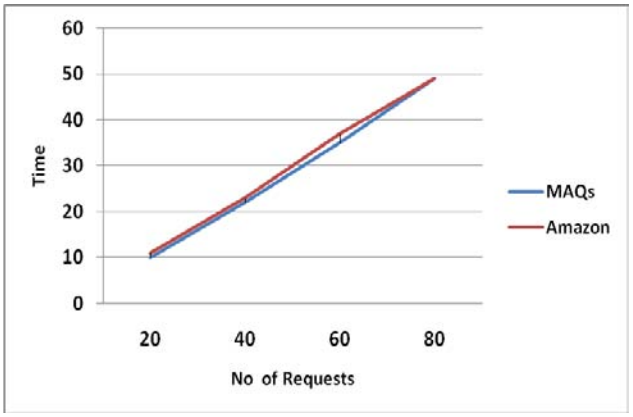

Figure 4 : Comparison of MAQs and Amazon

VII. Conclusion and Enhancement

In this paper, we have detailed our proposed solution for resource allocation using MAQS for collaborative cloud computing. Our mechanism has very good task completion ratio & success ratio. Through simulation in cloud-sim we have proved that our mechanism is able to give better QOS to the service providers. In future we plan to apply speculative execution to still improve the QOS and explore the optimal time period for training neural network with calculation of load factor.

References Références Referencias

1. L. Xiong and L. Liu, "Peertrust: Supporting Reputation-Based Trust for Peer-to-Peer Electronic Communities," IEEE Trans. Knowledge and Data Eng., vol. 16, no. 7, pp. 843-857, July 2004.
2. R. Zhou and K. Hwang, "PowerTrust: A Robust and Scalable Reputation System for Trusted Peer-to-Peer Computing," IEEE Trans. Parallel and Distributed Systems, vol. 18, no. 4, pp. 460- 473, 2008.
3. R. Zhou and K. Hwang, "Gossip-Based Reputation Management for Unstructured Peer-to-Peer Networks," IEEE Trans. Knowledge and Data Eng., 2007.
4. Haiying Shen, Senior member, IEEE, and Guoxin Liu, Student Member, IEEE, "An Efficient and Trustworthy Resource Sharing Platform for Collaborative Cloud Computing", IEEE Transactions on Parallel and distributed Systems, VOL. 25, NO. 4, April 2014.
5. J. Li, B. Li, Z. Du, and L. Meng, "CloudVO: Building a Secure Virtual Organization for Multiple Clouds Collaboration," Proc. 11th ACIS Int'l Conf. Software Eng. Artificial Intelligence Networking and Parallel/Distributed Computing (SNPD), 2010.
6. C. Liu, B.T. Loo, and Y. Mao, "Declarative Automated Cloud Resource Orchestration," Proc. Second ACM Symposium on Cloud Computing (SOCC '11), 2011.
7. K. Hwang, S. Kulkarni, and Y. Hu, "Cloud Security with Virtualized Defense and Reputation-Based Trust Management," Proc. IEEE Int'l Conf. Dependable, Autonomic and Secure Computing (DASC), 2009.
8. C. Liu, Y. Mao, J.E. Vander Merwe, and M.F. Fernandez, "Cloud Resource Orchestration: A Data Centric Approach," Proc. Conf. Innovative Data Systems Research (CIDR), 2011.
9. M. Srivatsa, L. Xiong, and L. Liu, "Trust guard: Countering Vulnerabilities in Reputation Management for Decentralized Overlay Networks," Proc. World Wide Web Conf., 2005.

This page is intentionally left blank