RESOURCE ALLOCATION IN CLOUD IAAS ENVIRONMENT BASED ON FORMING COALITION USING ACO

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ABSTRACT

Cloud computing is a model of sharing computing resources over communication network by using virtualization technique. Infrastructure as a service (IaaS) in cloud systems provides computational infrastructure services to various clients by means of VMs (Virtual Machines). The process of assigning the available resources to multiple clients based on the requests is known as resource allocation. During resource allocation process, service requests are such that not every VM requests can be allocated on a single machine, they may demand different VMs of varying configurations. Hence, coalition of machines needs to be formed to service every request. Coalitions of the machines created before the arrival of actual requests addresses scalability and also shortens the response times. The proposed system of resource allocation uses metaheuristic algorithm called Ant Colony Optimization (ACO) technique for coalition formation which finds near-optimal solution. Thus this method of coalition based resource allocation on the cloud leads to the maximum number of request satisfaction and better utilization of the resources.

Keywords: *Infrastructure-as-a-service (IaaS), Resource allocation, Virtual machines (VMs), Coalition, Ant colony Optimization.*

I. INTRODUCTION

Cloud computing is a type of computing that relies on sharing the computing resources rather than having local servers or personal devices to handle applications. In simple way cloud computing is "a type of Internet-based computing," where different services everything from applications to data centers are delivered to an organization's computers and user devices over the Internet on a pay-for-use basis.

The Three service models offered by cloud are: Infrastructure as a service (**IaaS**), Platform as a Service (**PaaS**), and Software as a Service (**SaaS**).

IaaS is a service that provides computational infrastructure services to multiple clients by means of VMs. PaaS provides platform support to the users to deploy consumer-created or acquired applications. SaaS provides consumers to use the provider's applications running on a cloud infrastructure. The applications are accessible from various remote client devices.

Our focus in this work is on allocation of resources in IaaS environment.VM plays a major role Infrastructure as a service created using virtualization technique. Virtualization is the main technology in cloud computing to deploy IaaS. Virtualization is the creation of a virtual rather than actual version of the machines. Thus Virtualization splits a single physical computer into multiple logical computers, or VMs, each accommodating its own guest software.

In cloud computing the process of resource allocation plays an important role in governing the performance of entire system and also the level of customer satisfaction provided by the system. Resource allocation is the process of allocating the available resources to the users according to their requirements. Today, the Cloud providers offers only the VMs of specific sizes such as VM size of Small, medium, large and extra large with predefined configurations. Figure 1 shows example VM configurations that may be requested.

However, while providing the utmost customer satisfaction, the service provider must also make sure of the profits to him also. So the resource allocation should be an economical on both the views i.e. on the end user side as well as the service provider side. Thus Resource allocation is an integral part of cloud computing is one of the major issues to be addressed. In this paper, the above issues on resources are addressed by coalition formation based on Ant Colony Optimization (ACO).

VM Type	CPU Core	Memory (GB)	Storage (TB)
Small	1	1.75	0.22
Medium	2	3	0.48
Large	4	7	0.98

Figure 1: VM Configurations

II. EXISTING SYSTEM

In the existing system, the users make the VM requests to the providers. The provider sees the availability of VMs with the host that is under its control. It searches based on the requirements of the user. When the request matches they allocate the resources to the users based on the availability.

When the resources are not available the users are made to wait in the queue. This process of queuing the requests instead of immediate provisioning of resources leads to performance degradation at provider's site. Hence, coalition of machines is formed.

This coalition is modeled as a game and played between the allocator and the host. Since it involves the uncertainty principle of game theory [1] for coalition, the system has disadvantages like more computations, complexity in solving and also mainly its based only on the cost for coalition formation.

III. PROPOSED SYSTEM

The user's task requirements are such that not all the types of virtual machines (VMs) can be hosted on a single machine. Incoming task requests may be demanding virtual machines of different capacities. To handle such a situation, coalition of machine is needed to be formed to service any particular request at a single host. In the proposed system coalition is formed using an Ant Colony Optimization (ACO) technique. ACO is a metaheuristic algorithm suitable for optimization. The proposed system is topology aware and demand aware. The topology information is used by the ants to form the coalition. The ants find the machines that are nearby in location based on the QoS parameters such as cost, response time, and availability. Thus the machines are collated before the actual task request arrives. When the request from users arrives, if a request match is found in the coalition then the task is allocated to the corresponding coalition. If none of the available coalitions satisfies the necessity of the task, then the task allocator is forced to allocate the task to a group of host machines. After the assigned tasks are executed coalitions is dissolved and machine become available to form any other coalition. If the assigned task is being executed then it continues its execution undisturbed under the coalition.

IV. SYSTEM ARCHITECTURE

The figure 2 shows the proposed system architecture.

The system describes that the cloud users from various locations makes request for required instances of preconfigured virtual resources (VMs) in IaaS environment. The service provider who receives the request from the customers makes allocation of resources from the virtual infrastructure based on the requirements of user's tasks and the resource availability. Virtual infrastructure is the place where the proposed system implementation id done. Coalitions of machines are formed at the virtual infrastructure to service a particular request at a single host. This Coalition of machines is done before the actual request arrival based on demand aware information. Then the resources are allocated to the requests from the available coalitions of machines. The knowledge base has all information regarding availability of VMs, Machine Configuration and the VMs in coalitions.

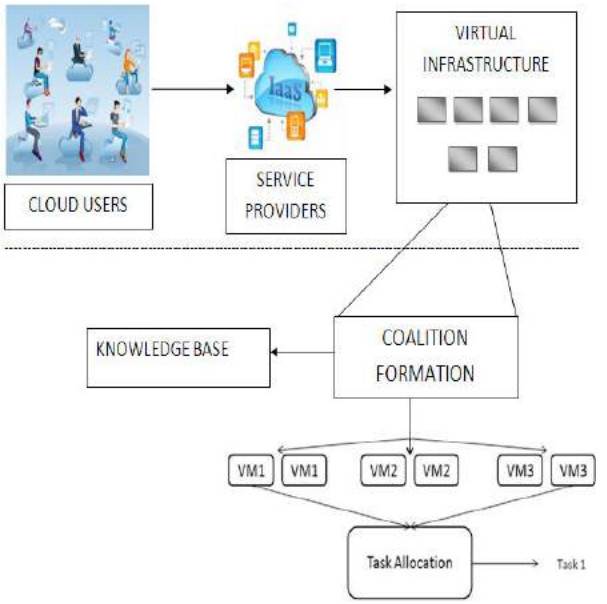

Figure 2: System Architecture

V. ANT COLONY OPTIMIZATION (ACO)

Ant Colony Optimization (ACO) is one of the metaheuristic algorithms which were originated from the foraging behavior of original ants. Ants explore their adjacent area

near to their nest in a random way to search food. It first examines the features and the quantity of food, and then it brings some portion of it on its back to the nest. While returning back, then it spreads a chemical pheromone trail on the surface. This is done to direct other ants to find the origin of the food. As this process continues, all ants are attracted to choose the shortest path based on huge accumulation of pheromone on the path. This algorithm has strong point in cooperation of searches and implemented with numerous optimization problems. Modulating this problem as the discrete one, the technique of Ant Colony Optimization is applied since it is best for discrete optimization process.

A. COALITION OF HOST

Coalition is the temporary union of combined action. Since the system is demand aware, we know the type of request that arrives but not the exact one, using this information it is easy for forming coalition so that the request can satisfied as and when they are arrived. For this coalition formation ant colony optimization (ACO) is used. The process of Coalition Algorithm is given below.

ALG 1: COALITION FORMATION

begin CoalitionformationAlgorithm
for each Host in totalnumOfHost do
if Host_status=Ready then
add Host to available Host_set
for each Host in available Host_set do
H= {}
A (Best H) = {}
Best = 0
for each H Start to end in host do
for each task requirements do
if Best<$H_{(i)}$ (Utility) then
Best=$H_{(i)}$ (Utility)
Add best to Coalition
Count=Count+1
Set Host_CoalitionStatus=Engaged
if numOfCoalition reaches Max_Coalition then
Stop Coalition
End CoalitionformationAlgorithm

B. TASK ALLOCATION

ALG 2 explains the task allocation process. If the request of task is found in the coalition then the task is allocated to the corresponding resources under coalition Task allocation needed the following inputs:

i. Set of tasks from users
ii. Set of available coalitions

ALG 3: TASK ALLOCATION

begin TaskAllocationProcess
for each Coalition in a Coalition_set do
if TaskRequirements matches Coalition Capability and CoalitionStatus=Available then
Allocate Task to the Coalition
Set CoalitionTask id=UserTask id
Change CoalitionStatus=Allocated
else
Allocate Task to individualHost
End TaskAllocationProcess

C. DISSOLUTION PROCESS

This process takes two inputs they are: coalition to be dissolved and the task that is being serviced. It checks for the completion of the task that is executed by the virtual machines. If the task completed its execution, then the members of the coalition are added to the set of available agents. The capabilities of the host machine are also released and then the status is updated. If the task under consideration is not completed and it is still executing then it is left as unchanged without disturbing the executing tasks.ALG 3 given below explains the above process:

ALG 3: COALITION DISSOLUTION

```
Begin CoalitionDissolutionAlgoriithm
    if CoalitionTask id=UserTask id and
       TaskStatus=Completed then
          for each H in Coalition_set do
                    Change H as Available
                    Update Coalition Capability
    else
          Continue TaskExecutionProcess
          StatusChange=NULL
End CoalitionDissolutionAlgoriithm
```

VI. IMPLEMENTATION

The Proposed system is implemented using CloudSim. CloudSim is a framework for modeling and simulation of cloud computing infrastructures and services. It provides basic classes for describing data centers, virtual machines, applications, users, computational resources, and policies for management of diverse parts of the system.

The simulation results show that the resource utilization is higher in the proposed ant colony techniques based coalition compared to the other traditional mechanisms. Also it minimizes the resource wastage to its maximum level. The comparison is showed in the figure 3.

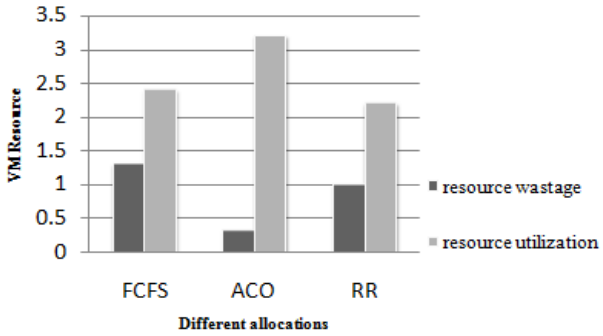

Figure 3: Results on resource utilization and wastage

VII. CONCLUSION

In cloud, the process of resource allocation aims at avoiding under-utilization of the resources. Through the proposed work, it is shown that use of Ant colony optimization (ACO) for forming coalition among machines is mainly to satisfy the user requests requiring capabilities beyond that of a single machine. Virtualization of the required resources is done by forming coalitions of host machines. The advantage of our approach is that, when the allocation mechanism is deployed, it is found to perform better with respect to lower wastage of resources and the task allocation time, also satisfying more number of user requests thus leading to maximum utilization of the resources.

REFRENCES

[1] P.S.Pillai and S.Rao, "Resource allocation in cloud computing using the uncertainty principle of game theory",IEEE systems journal vol 10,No.2,2016.

[2] Ashraf and I. Porres, "Using ant colony system to consolidate multiple web applications in a cloud environment," in Proc. 22nd Euromicro Int. Conf. Parallel, Distrib. Netw.-Based Process., pp. 482–489,2014.

[3] Fahimeh Farahnakian,Pasi Liljeberg, Juha Plosila, Ivan Porres, and Hannu Tenhunen, "Using Ant Colony System to Consolidate VMs for Green Cloud Computing", in IEEE transactions on services computing, vol. 8, no. 2,2015.

[4] Li-Der Chou, Hui-Fan Chen, Fan-Hsun Tseng ,Han-Chieh Chao and Yao-Jen Chang, "DPRA: Dynamic Power-Saving Resource Allocation for Cloud Data Center Using Particle Swarm

Optimization", in IEEE systems journal,2016.

[5] M. Gokilavani, S. Selvi, C. Udhaya kumar, ―A Survey on Resource Allocation and Task Scheduling Algorithms in Cloud Environment‖, IJEIT, Volume 3, Issue 4,2013.

[6] R. N. Calheiros, R. Ranjan, A. A. F. De Rose, and R. Buyya ,"CloudSim: A toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms," Softw.: Prac. Exp., vol. 41, no. 1, pp. 23–50,2011.

[7] http://www.cloudbus.org/clousim/

[8] IBM Cloud Computing: Infrastructure as a Service, Jun. 2013. [Online].

[9] P. S. Pillai and S. Rao, "A resource allocation mechanism using coalition formation and the uncertainty principle of game theory," in Proc. 7th Annu. IEEE Int. SysCon, Orlando, FL, USA, pp. 178–184,2013.

[10] P.-Y. Yin and J.-Y. Wang , "Ant colony optimization for the nonlinear resource allocation problem," Appl. Math. Comput., vol. 174, no. 2, pp. 1438–1453,2006.

[11] Ratan Mishra and Anant Jaiswal, ―Ant colony Optimization: A Solution of Load balancing in Cloud‖, in: International Journal of Web & Semantic Technology Vol 3, PP 33-50 ,DOI: 10.5121/ijwest.2012.

[12] S. Kraus, O. Shehory, and G. Taase, "Coalition formation with uncertain heterogeneous information," in Proc. 2nd Int. Joint Conf. AAMAS, pp. 1–8,2003.

[13] Zhen Xiao, Weijia Song, and Qi Chen,"Dynamic Resource Allocation using Virtual Machines for Cloud Computing Environment" , IEEE Transaction on parallel and distributed systems,2013.

[14] Priyanka, Prof. Mayank Bhatt, and Rishiraj,"Ant Colony Optimization Based Dynamic Resource Scheduling for Improving Cloud Performance" IJSETR, Volume 3, Issue 11,. 45,2014.

[15] X. Meng, C. Isci, J. O. Kephart, L. Zhang, E. Bouillet, and D. E. Pendarakis. Efficient resource provisioning in compute clouds via vm multiplexing. In ICAC, pages 11–20, 2010.

[16] S.Mathur, L. Sankaranarayanan, and N. Mandayam, "Coalitional games in receiver cooperation for spectrum sharing," in Proc. Conf. on Information Sciences and Systems, Mar. 2006, pp. 949–954.