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Resource Allocation and Management in cloud environment using hybrid Bio-inspired algorithm

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ABSTRACT

Tasks demand for dynamic resources at a rapid rate in the cloud environment and satisfying these demands is a challenging task. VMs must have enough resources to execute clients' tasks and providing these resources to VMs is managed by various algorithms. . In this proposed work allocation and management of resources (CPU and Memory), as demanded by the tasks, is handled by proposed HYBRID Bio-Inspired algorithm (Modified PSO + Modified CSO).it provide efficient utilization of the cloud resources, improved reliability and reduced average response time.

Keywords : Bio-Inspired Algorithms, resource allocation, Hybrid Bio-inspired Algorithm, MPSO, MCSO

I. INTRODUCTION

Cloud computing is a computing utility which has infinite capacity, instantaneous scalability and user pays only for the resources they use and only for time duration they are using it .

The exciting task of cloud environment is to allocating the resources using lowest overhead interval along with efficient utilization of existing resources. Using virtual machine scheduling techniques resources are allocated in cloud data center. Many users can simultaneously make the request for service in cloud environment. Therefore to improve the system performance and reducing the cost, an effective resource allocation and VM scheduling technique is needed.

1.1Virtualization

Virtualization is an abstraction of computer resources. It can be possible to access resources in consistent way before and after abstraction through virtualization. Virtualization supports migration of virtual machines from existing to other physical machines. Migration process transfers the main memory pages and states of virtual machine to a target machine. Migration policy decides when, which and where to migrate a virtual machine. One example is, there is high load on a physical machine and not sufficient resource available for a virtual machine, that virtual machine is migrated to a less utilized physical machine. Placement policy decides where to put a newly created virtual machine. For example, this may depend on current resource utilization of physical machine or number of already running virtual machines or type of applications that will run on virtual machine. Since in cloud computing, applications experience high variation of demand, virtualization can dynamically help to allocate resources.

1.2 Resource Management

It is a process which includes resource discovery then allocation of resources and finally monitoring the status of resources as shown in Fig. 1. It manages computing resources for ex. CPU-cores, memory consumption & network bandwidth etc.… [2].These resources as per need it divided and shared between VM's running possibly mixed workloads. The basic component of resource management is the Resource discovery process. Which determines the suitable types of available resources as per the application requirements [3]. This process is managed by the cloud service provider. The full information of resources availability is determined by resource discovery procedure. According to [4], resource discovery offer a method for a resource management system (RMS) for determining the status of the resources that are managed by it and other Resource management systems that interrelate with it. The resource discovery works with distribution of resources to provide information about the state of resources to the Server.

Element of Resource management

1. Monitoring : Monitoring the client/cloud subscriber and availability of resources.
2. Allocation :allocate the resources
3. Discovery : discovery and provisioning of resources.

1.3 Importance of Resource Allocation

The optimal resource allocation policy should prevent the conditions as follows:

• *Resource contention*: when two requests attempt to access the similar resource at the same time then such type of situation arises.

• *Scarcity of resources*: when there are inadequate resources, then such condition is arises.

• *Resource fragmentation*: such type of condition occurs when there are sufficient resources but not able to access for required application.

• *Over-provisioning*: Such type of situation arises when the demand is less and resource availability is more than the demand.

• *Under-provisioning*: Such type of situation arises when the demand is less and resource availability is more than the demand.

1.4 Resource Allocation Policies

A. RR-R: allocates VMs in a round-robin (RR) manner across racks (-R).

B. RR-S: allocates VMs in a round-robin (RR) manner across servers (-S). This is the default policy used by Eucalyptus [14] and, based on work by Ristenpart et al. [15], we also believe that it is closest to what is used by Amazon's EC2 for a single job. In order to positively bias RR-S results, we also enabled this policy to select racks with the highest available bandwidth first

C. H-1: A hybrid policy that combines RR-S and RR-R with a preference for selecting servers in the rack with the greatest available bandwidth.

II. LITERATURE REVIEW

Author[1] reviewed the various resource allocation strategies such as Black and Grey box strategies with BG algorithm, Vector dot algorithm, Skewness and load prediction algorithm, resource allocation strategy using feedback control theory, adaptive resource allocation algorithm, Adaptive list scheduling (ALS) and adaptive min-min scheduling (AMMS) algorithms, the main objective of all these algorithms sufficiently satisfy customer demand and their application requirement along with cost to provide should be minimum.

Black and Grey box strategies with BG algorithm proposed by T. Wood et al. [2] which uses Xen hypervisor and finds with Nucleus and monitoring engine black box is not possible to make proactive decision making, whereas Grey-box permits proactive decision making. Drawback of Black-box is restricted with reactive decision making and BG algorithm needs higher number of migrations.

For Dynamic resource allocation Zhen Xiao [4] gives Skewness algorithm. Which uses Xen hypervisor Usher controller for resource allocation. The advantages of this technique is no overheads & high performance. It requires very few number of migrations and remaining resource is responsive to virtual machines. Which impacts the scheduling is done effectively. The disadvantage of this scheme is it is not cost effective.

Qiang et al. [5] which proposed resource allocation approach using feedback control theory, for appropriate controlling of virtualized resources, which is based on virtual machine (VM).The author explained the advantage of shared space of cloud infrastructure. This technique contains VM-based architecture, in which all hardware resources are collected into common shared space of cloud computing infrastructure so that hosted application can right to use the essential resources as per there requirement in order to meet Service Level Objective of application. The adaptive manager used in this technique is multi-input multioutput (MIMO) resource manager, which contains 3 controllers: CPU controller, memory controller and I/O controller, its objective is control various virtualized resources utilization to achieve SLOs of application by taking controller inputs per-VM CPU, memory and I/O allocation.

A.Meera and S.Swamynathan proposed an approach for allocating resources based on the analyzed data that is being analyzed by a monitoring agent. The monitoring agent will collect the resources usage information that is currently being used by a virtual machine and will display it in a dashboard. Statistical report that is being displayed on a dashboard provides an information for cloud administrator for better optimization of resources. At this point this approach suffers from the centralized coordination because agents are not autonomous so future work can be focused on autonomous agents.

Kyle Chard, Simon Caton, Kris Bubendorfer, Omer Rana proposed an approach of a social cloud for sharing the resources on the base of relationship, trust and risk, and policies with the coordination of social market. A Social cloud is resource and service sharing framework utilizing relationships

Diptangshu Pandit, Matangini Chattopadhyay, and Nabendu Chaki proposed an efficient resource allocation algorithm with the use of simulated annealing. In this approach authors had introduced the concept of bin, soft computing and simulated annealing. In this approach, problem of resource allocation is being solved with the help of bin packing problem. In this approach temperature is being considered as a control parameter but no formal procedure of selecting the temperature has been described in this approach.

III.PROPOSED METHOD

3.1Resource Allocation and Management Using Modified Particle Swarm Optimization (MPSO) Algorithm

Tasks demand for dynamic resources at a rapid rate in the cloud environment and satisfying these demands is a challenging task. VMs must have enough resources to execute clients' tasks and providing these resources to VMs is managed by the proposed MPSO. Let us assume that there is a cloud resource pool (Res pool) which provides the resources demanded by the tasks and it acts as a resource repository. Each of the VMs has at least two minimum resources (CPU and Memory) for executing a task. first iteration, for all VMs, resources are given by cloud resource pool and from the second iteration onwards it depends on the resources as demanded by the tasks. Each of the VMs will not use all the resources for execution of tasks and these unused excess resources which remain with the VMs can be utilized for the future tasks demands. Our proposed MPSO algorithm plays an important role in assigning these unused resources either from the VMs or from the cloud resource pool. For better efficiency, let us form a clusters {c1, c2, c3,...,c z} from the VMs {vm0,vm1,vm2,...,vmk} which operate in both sequential and parallel modes. For parallel mode execution, we need at least two clusters. For subsequent assignment of resources to the VMs, let us take the best two excess resources i.e. excess res1 and excess res2 (VMs which have unused extra resources) from each cluster and check for match with the next resource demands. If the next resource demands match with the best values (unused resources), then VMs start executing the task immediately, or else the resources are taken from the resource pool for the execution. After each iteration, if there are any unmatched/unused resources then these resources can be released to the resource pool. Once VMs complete the execution of a task, then the minimum resources available with VMs can be released to the cloud resource pool. The main focus is on utilizing the resources from the VMs rather than lending the resources from the resource pool.

3.2Resource Allocation and Management using Modified Cat Swarm Optimization (MCSO) Algorithm

Cats always remain calm and move slowly and this behavior of cats is referred to as seeking mode. When the presence of prey (resource match happens) is sensed, then cats chase it with high speed, and this behavior is represented by the tracing mode. The tracing mode acts similar to that of MPSO algorithm, but seeking mode awaits the opportunity to capture a prey. It mainly concentrate on seeking mode rather than tracing mode. In Algorithm 2, it matches only with the excess res1 and excess res2 values from each cluster, but the remaining excessive resources from each cluster are not considered for the assignment and this issue is addressed in the proposed MCSO algorithm. The seeking mode of MCSO passes through four different types of memories. The excess resources available with VMs other than excess res1 and excess res2 are stored in the seeking memory pool . Using SMP, the cats await the opportunity in order to find the exact match with the future resource demands from the tasks. If there is a match, then status is stored in the seeking range of selected dimension . If SRD has a new update, then VMs start executing the task and this status is referred to as counts to dimension change . Cats position is changing in every update of seeking mode of MCSO and it is stored in self position consideration .

3.3Resource Allocation and Management Using HYBRID (MPSO+MCSO) Algorithm

The limitations of the MPSO and MCSO algorithms can be overcome by our proposed HYBRID (MPSO+MCSO) Bio-Inspired algorithm which combines the merits of both MPSO and MCSO techniques. Thus HYBRID approach provides a better efficiency in terms of allocation of resources with reduced total execution time. Further, communication overhead between VMs and resource pool is marginally decreased. In MPSO and MCSO, we compare only exact matches of excess res1, excess res2 with the Needed res from future resource demands. In the worst-case, HYBRID approach may not work efficiently and degrades the performance of the resource allocation and thus the system will respond with high delay. To overcome this situation, we consider the excess res3[] which contains the remaining resources other than excess res1 and excess res2.

3.3.1ALGORITHM

```
Initialisation: Res pool, Needed res, min res=2 sum res= 0 say VMs ={vm0,vm1,vm2,...,vmk} say Clusters, Cz ={c1, c2, c3,..., cz} Cluster size = k/Cz

for all incoming requests{x1,x2,x3,...,xn}
Res demand←sum of resources from requests
Needed res←resource demand for each request
for all available VMs
sum res←sum res + Res demand
end for
if (iteration 1)
Res pool←Res pool - sum res
end if
else
for all Cluster size, Cz ={c1, c2, c3,..., cz}
excess res1←first best of cz
excess res2←second best of cz
excess res3[]←rest of first and second best of cz
end for
for all available VMs{vm0,vm1,vm2,...,vmk}
for all Cluster size, Cz ={c1, c2, c3,..., cz}
if (excess res1≥Needed res[])
VM executes using excess res1
else
Res pool←Res pool - Needed res[]
if (excess res2≥Needed res[])
VM executes using excess res2
else
Res pool←Res pool - Needed res[]
```

```
while (size 0f(excess res3[]))
if (excess res3[]≥Needed res[])
VM executes using excess res3[]
else
Res pool←Res pool Needed res[]
end while
end for
end for
Res pool ←Res pool + remaining Needed res[]
end for
```

In the proposed HYBRID approach, we modify the condition by checking the upper bounds of excess res1, excess res2 and excess res3[]so, we can decide how many resources from excess res1, excess res2andexcess res3[]should be given to the forthcoming task and the remaining extra resources can be returned to cloud Res pool. Thus, our proposed HYBRID algorithm outperforms MPSO and MCSO algorithms when considered individually.

IV. CONCLUSION

Hybrid algorithm(MPSO and MCSO) behaves intelligently as it combines the features of both MPSO Algorithms and MCSO algorithm with optimum modifications. HYBRID (MPSO+MCSO) approach is more efficient in allocating the resources to the VMs when compared to other algorithms.

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