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Performance Enhancement System for the Cloud with Multi Factor Resource Allocation Technique

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Abstract

Resource allocation management in a cloud computing environment is the vital problem. Resource allocation models, QoS, time, conditions of the request for access to services are factors to be focused. Therefore this paper proposes the dynamic resource allocation system which allocates to cloud users. The multi factor technique is applied to optimize the allocation of the virtual machine in cloud computing. In Virtual Machine, while job is allocated and executed in the job scheduler, the first process gets to server and allocates resources. The other remains in waiting state. This refer analyses different virtual machines multi factor such as CPU, Time and Memory usage, Space and Speed. It is used to reduce the job makespan of data processing time and job waiting time, turn out time, to allocate resource efficiently. This system that effectively reducesthe system overload and with multi factors load prediction, the number of physical servers. It achieves better performance in terms of server resource utilization with the response time and minimizes the energy consumption.

Keyword: Cloud Computing, Resource Management, Resource allocation, Job Scheduling, Virtual Machine, CPU Load, Memory Load.

I. Introduction

Cloud computing is a developing new technology of huge scale distributed computing. The main role of cloud computingis to reduce the operational cost and capital, better performance in terms of data processing time and response time, maintain the system stability for future modification in the system. In cloud environment, resources are shared but they are not properly managed and distributed then it will result in resource wastage. Today the need for resources is increasing drastically day by day. Therefore, it is essential to allocate the resources properly.This led to the dynamic resource allocation. For this, multi factor technology is used that migrate virtual machines to physical machines effectively.

There are various technical challenges that need to be addressed incloud computing like Virtual machine migration, and resource allocation, fault tolerance, server consolidation, scalability and high availability but the central issue is the resource allocation.The multi factor mechanism, of distributing the load among various nodes to improve both resource utilization and job response time. It avoids thesituation where some of the nodes are idle or doing little work than heavily loaded. It also ensures that all the processor in the system doapproximately the equal amount of work at any instant of time.

The multi factor technique can divide the traffic between the servers that facilitates networks and resources by providing a maximum throughput without any delay. This is done with the help of Datacenter Controllers which use the predetermined parameters, such as the current load of CPU, Memory, Speed and the availability of memory. The multi factor must take into account for two major tasks. One is the resource allocation or resource provisioning and another isthe task scheduling. Resources are allocated in such a manner that all the available resources in the cloud do not undergo any kind of wastage and none of the servers is overloaded. Task scheduling is done after the allocation of resources to all cloud entities and allocatedwhich is available to the end user.

Cloud provides the architecture of four basic entities. These are host, datacentres, virtual machine and application which allow the user to set-up a basic cloud computing environment. Datacenters are responsible for providing Infrastructure level services and hosts are responsible for providing Software level service to the Cloud Users. Hosts have their own memory and storage; the processing capabilities of hosts are measured in MIPS (million instructions per second). Virtual Machine allows deployment as well as the development of custom application service models. System software and Applications are executed on Virtual Machine on-demand [1].

II. Related work

Chee Shin Yeo et al., [2]the proposed method to enhance the utility based on SLA of the cluster. This model containing four QoS parameters such as deadline type, budget, penalty rates, it describes the LibraSLA. LibraSLA is related to Admin control and Resource allocation algorithm. This simulated to compare better than Libra followed by more job deadlines and minimizing the penalties. This supports the SLAs in cluster level resource allocation for service-oriented grid computing.

David L, et al., [3] the proposed Heuristics Robust Resource allocation in parallel with distributed computing. This technology introduced two phases greedy heuristic (BASIC) and iterative heuristic (Steady State Genetic Algorithm). Both algorithms minimize the routing time. It is based on the min-min algorithm, whereas applied to steady state GA, this algorithm gives the solution to the machine when fails, it increase the system load.

Daniel warneke et al., [4] the authors presented Nephele, it is the first framework of data processing the center. It is used to allocate resources dynamically and reallocate, scheduling tasks, execution of the Iaas cloud. The task can be assigned different type virtual machine, which is initialized and terminated during the job execution with automatically. These virtual machines based on the framework compare the data processing better Hadoop. It can be extended MapReduce. It improves to reduce the processing costs and the overall resource utilization for consequentially.

Sharma et al., [5] in this paper the authors proposed the bidding model. This model consists of three stages, stage1: Grid in the client-side algorithm, stage2: Resource Allocation and stage 3: Resource provider, the algorithm provides the solution to the resource management in grids. It is referred to map the different types of resources (bandwidth, processing power).After allocating the resources, and again keep checking on the resources in the queue. This main objective of this algorithm is to decreases the number of tasks and maximum utilization of resources.

Alexander Ser et al., [6] the authors presented the Adaptive resource allocation predictive model. This model monitor the service request, system changes, allocation of resource, it's based on the SOA. The service requests and an efficient resource allocation can be made optimal and are related to correlation and hypothesis testing.

Zhangxi Lin et al., [7] proposed the economic-based approach to resource allocation in web service and pricing for web service. Here the authors proposed the web service provided two models. **Profit maximization**: it focuses on the adopted, charges organization, user prices, and services, our own benefit of considering user utilities. **Welfare maximization model:** The organization adoptive, own benefit and set price with other utilities. It is based on the client consuming the network bandwidth, storage, throughput, QoS and CPU time.

Norman Bobroff et al., [8] in this paper MFR and static algorithm are proposed by the authors. The MFR algorithm accessing the horizontal axis, static algorithm accessing vertical axis at specified values, the capacity of the violation rate presented the physical server to the virtual machine. It indicated the demand changes, migration between both of the physical as well as virtual machines hosting the allocated applications. Time series forecasting and bin packing heuristic algorithms are combined in order to minimize the physical machine workload.

Timothy wood et al., [9] the author here introduced techniques as automated black and gray box these techniques automatically monitoring system, hotspot detection, new mapping, load the migration, both these techniques applied to sandipiper system and hotspot detection algorithms. The hotspot detection component monitoring, proofing engine usages gather on various virtual and physical servers. **Unobtrusive Black Box monitoring;** it is responsible for each virtual server processor, network, memory, usage, and finds the VM total resource usage. **Gray box monitoring;** It is used to monitor each virtual server. In Linux, monitoring demanded the interface together CPU, network, memory usage. **Profile Generation**: It received the report on the resource from each nucleus. It maintains user history; generate to report on the virtual machine to physical machines. It maintained the CPU utilization, network bandwidth, swap rates, memory, service time, drop rate and increment the request rate. **Hotspot Detection;** It is responsible for signalling, need for VM migration with SLA violation.

Monika choudhary et al., [10] the authors here in this proposed paper, designed the Greeding deadline based and cost based scheduling algorithm. It is based on the framework as follows, Task Grouping; it is a collection of compositions based on certain behavior. This behavior framework constraint can be a deadline or minimize the cost. **Prioritization;** It is important to task elements, this element order for the task scheduling parameters. In this framework short deadline based and priority order executed. This approach makes it maximize the profit and minimize the cost base of the VM. **Greedy Allocation;**The dynamic heterogeneous scheduling resource environment best suitable for greedy algorithms. It resolves the job scheduling problem. **Deadline constrained based Greedy algorithm;** the Greedy algorithm is used to improve the competition of task. It is used to minimize the turnaround task from the individual task. Below the equation used to find the turnaround time.

$$\text{Turnaround Time} = \frac{\text{Resource waiting time} + \text{Task length}}{\text{Proc. Power of Resource}} \quad (1)$$

After calculating turnaround time for each resource, status can be updated. According to above the equation resource selected with a minimum cost of sequential order. Both equations are simulated using CloudSim tool.

Ying Song et al., [11] has proposed the two-tier on demand resource allocation mechanism, this consists of local and global resource allocation. It is based on feedback from an on-demand capacity of application and also implemented a Xen_based prototype. Evaluated VM based shared a platform with above mention technique. The set of algorithms used for dynamic resource allocation, with according to the various time-sharing resource requirements and quality of hosted application, while as to improve the performance of the critical application.

Yogitachawla et al., [12] proposed the dynamically optimized cost-based task scheduling algorithm. The cost based task scheduling algorithms used by cloud user and dynamically optimizes the resource allocation beneficial to cloud service providers. These can improve the communication cost ratio, grouping the user task before resource allocation. Here resource cost is calculated by the equation given below;

Resource cost= (RAM of the virtual machine*Cost per memory) + (Size of virtual machine +Cost per storage) (2)

P.Malathi et al., [13] introduced the new method known as SPAR. These methods are partitioning the hotspot, coldspot. The hotspot solves the connected with VM and if any PM hot thresholds for resource utilization, it can be reduced the load balancing with the job. The coldspot solves the rate of resource utilization on green computing. Here, using the concept of "skewness". This can be improving the overall resource utilization, implementing and evaluating for dynamic resource allocation with multiple VM based on the end users. This enhances and achieves the green computing and load balancing.

B. Selvi et al., [14] proposed the Lopsidedness algorithm. This algorithm measures the unevenness of utilizing multiple resources on a server. It is combined the different type of workload and improve the server resource utilization .It described the **Hot and Cold Points;** It evaluates the resource allocation based on the future of VMs. The server defines the hotspot utilization by the resource thresholds. If the server is not hotspot state, the temperature is zero. The Cold spots to define the utilization of all of the resource below a cold threshold. This indicates the idle state of the server and turns off to save energy on the server actively one VM running otherwise it remains in inactive state. **Hotspot Reduction**; this eliminated the all the hotspot, otherwise keep their low possible temperature. It sorts the list of hotspot with descending temperature and reduces the VM temperature.

G. Sadasiva Prasad et al., [15] the author designed the mobile cloud and dynamically allocation of transport sector. This technique applied to allocate the resources in different time through different routers. It is coverers the speed of vehicles and distance of each route with mobile communication devices and acts as a traffic manager tool. It simulates the mathematical model and finds real time solutions.

Ravi Kumar U.Ighare et al., [16] proposed the threshold based dynamic resource allocation. It automates resource allocation and remapping the VM to PM. This allocation policy consisting of three stages **Virtual machines select;** set the two threshold values, **Upper utilization threshold;** This can be maximizing the resource used in threshold servers. It is free to avoid SLA violation, identifies the Hotspot .**Lower utilization thresholds;** it minimizes the resource utilization from a server and identifying the cold spot.

Ruiu P et al., [17] the authors proposed the DAViS, Dynamic Allocation of Virtual storage. It is based on the prototyping of the system. The optimization of resource utilization in a dynamically, it also resize the storage space and memory. The below specified parameters have been used for this mechanism. **Time spent for attaching a new value;** Attached the guest's volume and time needed to execute all instructions. **The free space of the volume after the threshold is executed:** It depends on upon the threshold values and the total disk size.

III. Performance measures of job scheduling:

There are a number of key metrics to evaluate the effectiveness of cloud scheduling algorithms. A single measure cannot capture the whole performance of the cloud. On the user's perspective, the key measures of cloud performance include (i) Time (ii) cost. Time includes average job response time and average waiting time, average execution time .The cost is the economic cost that an application needs to pay for resource utilization on the user's part, and cost also plays a role in measuring the performance of the system. Clouds like to optimize the performance of the resources. Here, the performance measures are (i) resource utilization, (ii) economic profit. Resource Utilization is the percentage of time that a component is actually occupied; as compared with the total time that component is available for use. On user's perspective, they want the cost and time to be reduced to the maximum extent, and at the same time, the resource providers want their resources to be efficiently and effectively utilized which may lead to higher profit. Considerationof all these parameters for performance measures may lead to compounded problem. Based on these measures, many works on economic models have come into existence.

Resource Allocation Methods

A. **Static Method:** In the static allocation, the cloud user has to make a prior request for the resources. By doing so a user knows what resources are required and how many instances of the resources are needed ahead of using the system. But the drawback is it leads to underutilization or overutilization of resources depending on the time the application is run.
B. **Dynamic Method:** Cloud resources are requested by the cloud user on the fly or as and when the application needs. Here underutilization and overutilization of resources are avoided as much as possible. But the requested resources might not be available when requested on the fly. The service provider has to make an allocation from other participating cloud data center [18]

Existing System:

In the existing system, the cloud computing customers need to create their own cloud of their computations which may be very costly. The job is assigned to server dynamically based on the request, time and demands.But actually passed the values after executing the web application, it is like the static data shared.

Disadvantages of the Existing System:

i. The data is shared dynamically but they specify memory at run time.
ii. It requires more time for execution [1].

IV. Proposed system architecture

Proposed Method:

In this paper proposed theautomated resource allocation systems that effectively allocate the web server to virtual machines. This technique uses the utilization multi factor to make the decision on virtual machine migration. The following goals are effectively achieved in this technique

Overload avoidance: The capacity of a Physical Machine should be sufficient to satisfy the resource needs of all Virtual Machines running on it. Otherwise, the Physical Machine is overloaded and can lead to degraded performance of its VMs.

Green computing: The number of PMs used should be minimized as long as they can still satisfy the needs of all VMs.

Advantage of Proposed System:

i. Job allocating will be done automatically.
ii. The system reduces job waiting and turnout time.
iii. Manage the resource utilization when needed.
iv. Optimal utilization of resources
v. Performing minimal number of migrations to the extent possible

SYSTEM ARCHITECTURE

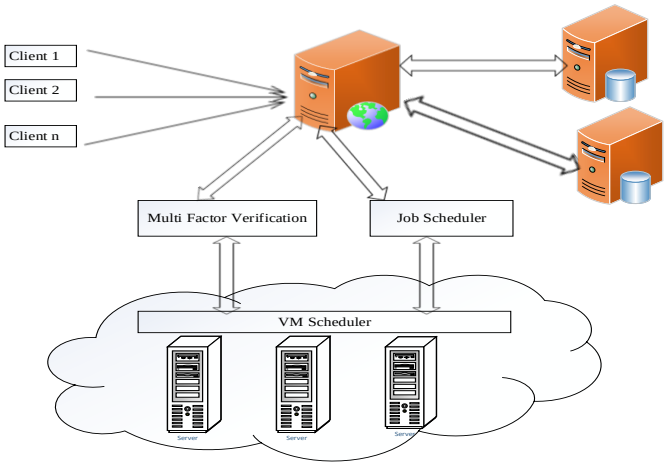

Figure1. System Architecture

The Resource allocation for load balancing is designed on the public cloud. It has the better performance for dynamic job allocation. This proposed architecture consists of the below modules. If the job scheduler module can act as client submits their requests tothe server which is present in the IaaS cloud environment. When an available resource task is assigned to a cloud, first resource availability in this cloud will be checked by the job scheduler. A job scheduler records the execution schedule of all resources using a slot and to check the resource availability in this cloud. The second module is resource allocation. In this module, the incoming requests are directed to the virtual machines. The third module is/are multi factor workflow. This factor will allow an incoming request to be routed to servers that host the web application.

A. Resource Management:

Dynamic resource management has become an area of research in the Cloud Computing paradigm. The cost of resources varies meaningfully depending on the configuration for using them. Hence efficient management of resources is the major importance of both Cloud Providers and Cloud Users. The success of any cloud management software critically de-pends on the flexibility; scale and efficiency with which it can apply the essential hardware resources and providing needed performance isolation. Successful resource management solution to cloud environments needs to deliver a rich set of resource controls for better isolation at the same time as doing first placement and multi factor for efficient utilization of essential resources.

B. Job scheduler

The client submits their requests for a server which is present in the IaaS cloud environment, the requests are placed in the queue and sent to the server. In scheduler [19] the requests are equally distributed among the nodes. The available resource task is assigned to a cloud; first resource availability in this cloud will be checked by the job scheduler. A job scheduler records execution schedule of all resources using a space. The job scheduler is used to simulate from users for virtual machines. In this module is consider a web service, which has different task, this web service application is placed on the server and made the user accessthese applications for the client machine

C. Resource allocation

In resource allocation, are selectedthe available resources depending upon the requirement of our task by using multi factor condition. The user sends the request to the server, the server identifies [20] the request and redirects to the particular virtual machine. The virtual machine processes the requested task and sends the corresponding response to the client request. If virtual machinesare overloaded, apply multi factor policies, it can redirect the incoming request for the other virtual machines to balance the load among cloud environment.

D. Virtualization:

Virtualization is an important technology of cloud computing. One version says that it collecting of hardware platform, operating system, and a storage device or network resources.VM live migration is a widely used technique for dynamic resource allocation in a virtualized environment. The process of running two or more logical computer system can be accommodated one set of physical hardware.

E. Allocation of virtual machines:

Allocation of virtual machines can be divided into parts. The first part considers the new requests for virtual machine provisioning and the transferring of virtual machines on hosts. The second part concentrates on optimizing the current allocation of virtual machines. The difficulty of the allocation part of the algorithm, it would be ‘n equal(=) m' which can be analyzed by calculating the number of check VMs multi factor ‘n' which has to be allocated and the number of hosts ‘m'. Further, the optimization of virtual machines current allocation is brought out in two steps (i) selection of the virtual machines that need to be transferred and (ii) placement of the selected virtual machines on the hosts through allocation multi factor technique.

F. Multi factor workflow

In Multi factor we have created a web application in which multiple numbers of users is allowed to access the virtual machines efficiently from the client side. Initially, the different

users use the application and submit the task to the server. The user's requests are placed in the task queue, it is sent to the job scheduler. The multi factor which checks for the availability of virtual resources is connected to it. Also, have the status information about every virtual machine which is connected to it. The status information represents the status of every virtual machine, such as whether it is an available state. Based on the status of virtual machines the task can be allocated to the virtual resources. For checking the availability of virtual machine are to be updated the status of the virtual machine CPU and Memory usage.

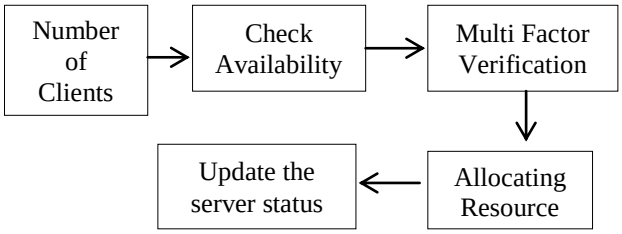

Figure2. Multi factor workflow

V. Results and Discussion

Implementation details

The performance of the proposed resource optimization framework is implemented using Dot net platform. Both Resource allocation and execution is solved by using different optimization problems under uncertainty. Resource Utilization and allocation are implemented in the proposed system. In Table 1 are displayed the job details and execution times, resources utilization. These experimental results show that Multi factor method improves the performance by consuming less time for scheduling virtual machines.

Table 1.Job Execution Details

Job ID	Arrival Time	Service Time	Start Time	Finish Time	Wait Time	Turnout Time
0	46	49	0	49	0	49
1	2	6	49	55	49	55
2	20	6	55	61	55	61
3	34	37	61	98	61	98
4	50	53	98	151	98	151
5	7	53	151	204	151	204
6	22	25	204	229	204	229
7	38	41	229	270	229	270
8	55	41	270	311	270	311
9	9	12	311	323	311	323
10	25	29	323	352	323	352
11	43	29	352	381	352	381
12	57	1	381	382	381	382
13	57	1	382	383	382	383
14	13	16	383	399	383	399
15	30	16	399	415	399	415
16	44	47	415	462	415	462
17	1	4	462	466	462	466
18	18	4	466	470	466	470
19	33	36	470	506	470	506
Average waiting time: **273.05Ms**						
Average turnaround time: **298.35Ms**						

Experimental results

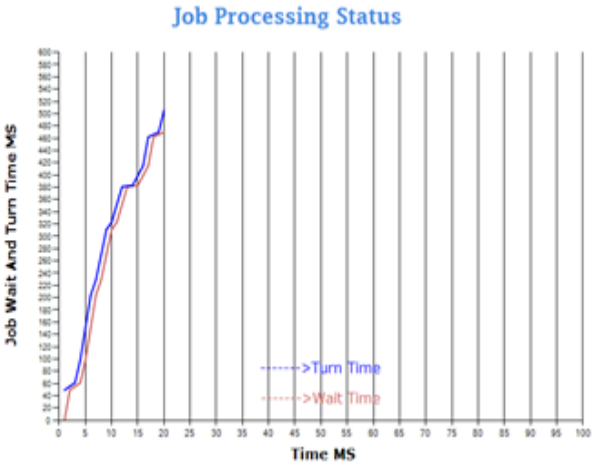

Figure 3.Average job waiting and turnout time in MS

Figure 3 shows the job waiting and turn out time of dynamic job allocation situation. Based on the results, the reference is that the multi factor technique has the minimum average execution and waiting time. The resource contentions occur when the best-effort job is pre-empted. That estimated finish time of the job is close to the actual finish time. Hence adaptive procedure does not impact the job execution time significantly.

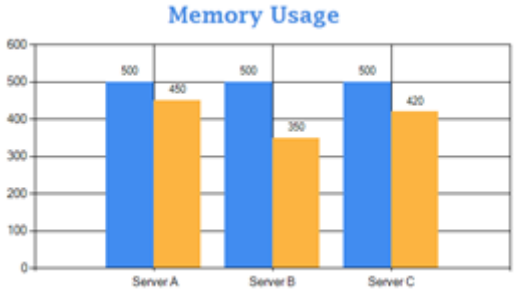

Figure 4.Memory usage status

The memory usage of VM server is shown in Figure.4.Using Multi factor admin UI, the memory usage is described. In this, x-axis gets the virtual machines and y-axis gets the total job allocated memory

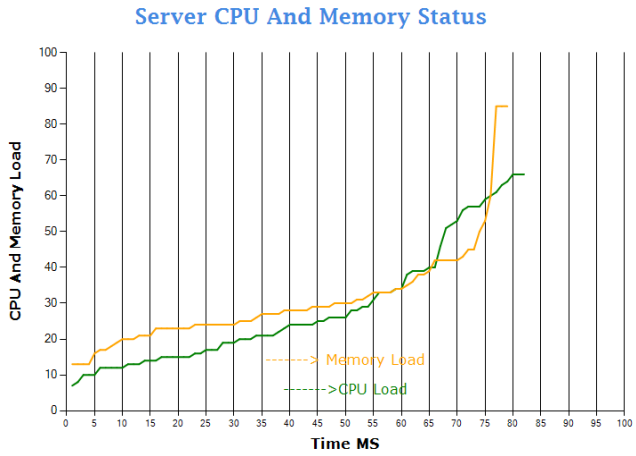

Figure 5. CPU and Memory Load status

The above Figure 5 pictures the minimizing of time for resource allocation based on CPU and Memory loader without any time delay for a particular task.

VI. Conclusion

In this paper, the dynamic resource allocation problem is considered in a cloud computing where each physical machine has a lot of virtual machines and each resource needs to use a number of virtual machines during a given and fixed period. The objective aims to minimize the total execution time on each physical machine. The multi factor technique used for resource allocation is to minimize waiting and turnout time for the user to process with lesser time using the options (VMs, memory) efficiently. The processes are allocated to the virtual machine for the desired time. Jobs may execute fast and chances of deadlock occurring are less. In this method, how job execution can be done on a virtual machine fast and dynamically is described. It is concluded that the proposed architectures are superior as it has less waiting time, response time, reducing the overhead and saving of memory space. Future work can be based on these architectures modified and implemented for the network problem and power energy problem.

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