Scientific Journal of Impact Factor (SJIF): 3.134

ISSN (Online): 2348-4470
ISSN (Print) : 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2, Issue 1, January -2015

A COMPARATIVE STUDY OF HEURISTIC LOAD BALANCING IN CLOUD ENVIRONMENT

Maimit A. Patel [#1], Asst. Prof. Rutvik Mehta [*2]

[#] Student Computer Science Department,*Information technology Department , [1] maimitp9@gmail.com

[#*] Parul Institute of Engineering and Technology, [#*] Gujarat Technological University , [2] rutvik.mehta1990@gmail.com

Abstract- *Cloud computing are distributed and parallel computing system, which facilitate virtualization of resources based on demand. It is new computing paradigm that goal, to provide reliable, customized and quality of services guaranteed computing environment for cloud user. In cloud computing, there are many tasks requires to be executed by the available resources to achieve best performance, minimum completion time, shortest response time, utilization of resources Due to randomness arrival of request in cloud, certain machines are overloaded and certain machine are under loaded or idle. Therefore, efficient load-balancing algorithm is required to improving performance of system, optimal utilization of resources. In this paper, different existing load balancing technique has discussed in order to manage the load among resources effectively and efficiently***.

Keywords: *Cloud Computing, Load Balancing, Resource Allocation, Task Scheduling.*

I. INTRODUCTION

Cloud computing provide more flexible way to get computation and storage resources on-demand and pay-as-you-go manner, rather than investing in large and expensive infrastructure, as well as owning (maintaining) it. Before submitting your final paper, check that the format conforms to this template. Specifically, check the appearance of the title and author block, the appearance of section headings, document margins, column width, column spacing and other features.

Cloud computing provide deployment model of resources (Hardware and Software) as services via public, private, or hybrid network [1]. A cloud computing is distributed and elastic system where resource are distributed through network (Cloud).To provide the communication between user and resource leads bottleneck due to complicacy and rising of demand. Thus, some of the resource in the network is over loaded and some are low loaded or not with the user request. It create system imbalance due to uneven utilization of resources. To overcome this problem efficient load balancing algorithm is needed for improve performance and resource utilization.

II. SIGNIFICANCE OF LOAD BALANCING IN CLOUD

Aim of load balancing in cloud is to balancing load among resource to obtain resource utilization, maximum throughput; minimum response time and overhead should be avoided.

Load balancing have done in two major tasks: one is resource allocation and second is task scheduling. Efficient resource allocation and scheduling of task and resource ensure [2]

- Resources are optimal utilized under over/low load condition.
- In case of low load save energy
- Resources are available easily on-demand
- Efficient allocation of resource to achieve minimum finish time

A. Resource Allocation

Resource allocation is process of mapping the different entity of cloud to resources on demand. Resources must allocate in such manner no resource are over loaded and low loaded in cloud and ensure do not undergo any kind of wastage(wastage of processing core or memory). Mapping of resource have done at two levels: one is Virtual machine (VM) mapping on to physical machine (host or PM) and task mapping on to virtual machine.

B. Task Scheduling

Once resources are allocated to task or application then task scheduling done. Scheduling define to mapping task to resources in order to achieve efficient result (minimum response time, minimum completion time etc.). Resource allocation defines that which resource will be available to fulfil user requirement [2]. Task scheduling term denote the manner in which allocated resources are available to user (i.e. resources are fully available till task completion or available in time sharing manner).

TABLE 1: COMPARISON OF RESOURCE ALLOCATION AND TASK SCHEDULING

Process	Sub-category	Issues

Resource Allocation	Host level VM level	Efficient Utilization Minimize Makespan Ensure Availability
Task Scheduling	Space-Sharing Time-Sharing	Minimize response time

Task scheduling done at two modes:

- Space-shared mode: Resources are not pre-empted (i.e. Resources are not allocated till task undergo complete execution)
- Time-shared mode: Resources are pre-empted (i.e. Resources are pre-empted continuously until task undergoes completion.)

III. EXISTING LOAD BALANCING ALGORITHMS

Load balancing algorithms influences the effect of balancing the server workload [3]. Its main role is how to decide a new node to transfer new arrival requests. In this section, we discuss different existing load balancing algorithms based on their classification:

A. Static Environment

Load balancing in static environment, cloud provider need priory knowledge about nodes (Processing power, capacity, storage memory etc.) and user requirement. Resources in cloud are not flexible in case of static environment and cloud provider provide homogeneous pool of resource (with same configuration).This type of load balancing algorithms are easy to implement but limitation is it cannot adapt run-time variation in load. It is mostly suited for homogeneous pool of resource.

Round Robin Algorithm [3] well suited for static environment. In this algorithm, time is divided into multiple time quantum. Each nodes assign a time quantum during this each node perform its operation. In Round Robin Algorithm, resources are allocated to the task in FCFS (First Come First Serve) based on time quantum. User request perform its operation within given time quantum after time quantum is over and next request in queue assign this time quantum. If request has not complete its operation within given time quantum than it has to wait for next turn.

Opportunistic Load Balancing (OLB) [4] schedule each task in random order to next expected available machine, without the task's expected execution time on that machine. The intention of OLB is to keep all machines as busy as possible. One advantages of OLB is its simplicity but limitations are same as Round Robin.

The Min-Min Algorithm [6] begins with the set of all unmapped tasks (Set U). Then, the set of minimum completion times, M, for each task ti ϵ U, is found. Moreover, the task with the overall minimum completion time from M has selected and assigned to the corresponding machine (Thus named Min-min). Than newly mapped task is deleted from U, and the process repeats until all tasks are mapped (i.e., U is empty).

Max-Min Algorithm [6] is similar to Min-Min Algorithm and it begins with the set of unmapped tasks. Let U be the set of all unmapped tasks. Then, the set of minimum completion times, M, is found. The heuristic then selects overall maximum completion time from M and assigns to the resembling machine. Therefore, it named as Max-min Algorithm. Finally, the new mapped task is removed from U, and the process keeps on repeating until all tasks are mapped which implies until U is empty.

B. Dynamic Environment

Load Balancing in Dynamic Environment cloud provider don't need priory knowledge of nodes it rely on run-time statistic. It is complex to implement but it is able to adapt variation in load at run-time. In dynamic environment cloud provide heterogeneous pool of resources and ensure the flexibility of resources.

Load Balance Min-Min Algorithm (LBMM) [5] algorithm is proposed that reduces the makespan and increases the resource utilization. The proposed method has two-phases. In first round, LBMM executes Min-Min algorithm. In the second round, it chooses the resources with heavy load and reassigns them to the resources with light load. LBMM identifies the resources with heavy load by choosing the resource with high makespan in the schedule produced by Min-Min. It then considers the tasks assigned in that resource and chooses the task with minimum execution time on that resource.

C. Centralize Load Balancing

In centralized load balancing, all the decisions (i.e. resource allocation and task scheduling) have been making by the single node, therefore, it create overhead on that node due to

TABLE 2: COMPARISON: EXISTING LOAD BALANCING ALGORITHMS IN CLOUD COMPUTING.

Algorithm	Static	Centralized	Dynamic	Distributed

	Environment	Balancing	Environment	Balancing
Round Robin[3]	✓	✓	×	×
Min-Min[6]	✓	✓	×	×
OLB[4]	✓	✓	×	×
Max-Min[6]	✓	✓	×	×
LBMM[5]	×	×	✓	×
ACO[8]	×	×	✓	✓
HBB-LB[7]	×	×	✓	✓

multiple user requests and no longer fault tolerant. In case of failure of that, no one take the responsibility to take decision about resource allocation and load balancing. It is mostly suited with small network with low load.

D. Distributed Load Balancing

In distributed load balancing, there is no single node is responsible to take the resource allocation and task scheduling decision. There is multiple nodes are monitoring cloud network instead of single node. Therefore, load-balancing decision has distributed among different nodes. By that, system is fault tolerant and no single node is responsible to take load-balancing decision.

Honey Bee Behavior Inspired Load balancing Algorithm [7]. In this paper Dinesh babu L.D and P. Venkata Krishna proposed algorithm inspired by nature of real honeybee behavior. Algorithm balancing loads by switch the tasks from overloaded machine to underloaded machine. Select tasks for

switch using QoS (priority) i.e. priority of the tasks decide in machine such manner to minimize the long waiting time in queue of arrived task.

Ant Colony Optimization algorithm is random search algorithm [9]. ACO algorithm is uses the positive signal mechanism, follows the behaviour of real ant in order to food search, and connect to each other by pheromone lay on travelled path. ACO algorithm [8] has used in this paper to optimal resource allocation to task to minimize makespan.

IV. CONCLUSION

Load Balancing is an important process in cloud environment to obtain maximum resource utilization. We study different existing load balancing technique and understand role of each algorithms. Dynamic load balancing schemes is more suitable for heterogeneous pool of resources but it is complex to implement compare to static environment. On the other hand static environment provide homogeneous pool of resource but in can't adapt variation in load at run-time compare to dynamic environment. In centralized load balancing resource allocation and task scheduling decision made by single node due to this constrain the decision node have more overhead to take decision and no longer fault tolerant in case of failure of node compare to distributed load balancing. In distributed environment resource allocation and task scheduling decision made by multiple node. In that multiple node monitor the cloud network so it is fault tolerant and no node is overload to take load balancing decision. By comparative study about existing load balancing algorithms dynamic load balancing scheme in distributed environment is provide good performance compare to combine others.

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