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LOAD BALANCING IN CLOUD COMPUTING USING A NOVEL MINIMUM MAKESPAN ALGORITHM

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Abstract **-** Cloud Computing is computing over the internet offer huge power of computation to the user by paying for the services on demand. The load balancing is important factor in cloud computing environment. The paper compares Min-Min, Max-Min and RASA load balancing algorithm and present a algorithm for load balancing with Minimum Makespan. The algorithm with Minimum Makespan produces higher throughput by migrating resource to unallocated node. The paper compares the performance of above all algorithm by assuming a theoretical data.

Index Terms : Cloud Computing, Load Scheduling, Min-Min Scheduling, Max-Min Scheduling, RASA Algorithm, MinimumMakespan

I. INTRODUCTION

The cloud computing is the technology used over the Internet. Cloud Computing is based on the distributed computing providing scalable, hardware, software over the Internet. Cloud offers resources such as storage, computation, etc. It is the collection of servers distributed across the all-region of the world which provide different services on demand. In the cloud computing, actual processing is done by the remote servers. A cloud can be a public, private, or heterogeneous type. These clouds provide different services to the end-users on the demand. The most common services are Software as a Service (Saas), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). [18]

The private clouds are owned by an organization they have finite infrastructure and services they are secured from the outside world. While the public clouds offer large scale infrastructure and services to the client on the payment basis. Access to the public cloud is unlimited it can be accessed from any part of the world, public clouds arehighly prone to security control. The third type of cloud is Hybrid cloud they

are formed by the combination of public and private clouds. Hybrid cloud provides flexibility in trade-offs between the cost-savings and scalability of the public cloud and control of data resources at a private premise. Many vendors offer cloud services such as Amazon, AT & T, Eucalyptus System, Google, Microsoft and many more.[1][16][8][10][17]

II. LOAD BALANCING

Load balancing is the technique of distribution of workload among nodes in a distributed computing environment such that it ensures no node in the system is overloaded or sits idle for any instant of time. Cloud load balancing reduces costs and maximizes resource availability. An efficient load balancing algorithm will make sure that every node in the system does more or less same volume of work. The responsibility of load balancing algorithm is that to map the jobs which are set forth to the cloud domain to the unoccupied resources so that the overall available response time is improved as well as it provides efficient usage of resource utilization. Load Balancing is an important factor in cloud computing environment since we cannot predict the number of requests that are issued at each second in the cloud environment. The unpredictability is due to the ever-changing behavior of the cloud. The purpose of load balancing in the cloud computing is in allocating the load dynamically among the nodes in order to satisfy the user requirements and to provide

maximum resource utilization and maximum throughput by asserting the overall available load to distinct nodes.[16][4][6][11][12]

2.1 MIN- MIN LOAD BALANCING ALGORITHM

Min-Min is a simple and fast algorithm capable of providing improved performance. Min-Min schedules the ideal tasks at first which results in best schedules and improve the overall makespan. Assigning small task first is its drawback. Thus, smaller tasks will get executed first, while the larger tasks keep on in the waiting stage, which will finally result in poor machine use. Min-Min exhibits minimum completion time for jobs which are unassigned and later allocating the jobs with minimum completion time (hence min-min) to a node that is capable of handling it.[5][7] [9][14][12]

2.2 MAX- MIN LOAD BALANCING

At first for all the available tasks are submitted to the system and minimum completion time for all of them are calculated, then among these tasks the one which is having the completion time, the maximum is chosen and that is allocated to the corresponding machine. If in a task set only a single long task is presented then, Max-Min algorithm runs short tasks concurrently along with the long task. Max-Min is almost identical to Min-Min, except it selects the task having the maximum completion time and allocates to the corresponding machine. The algorithm suffers from starvation where the tasks having the maximum completion time will get executed first while leaving behind the tasks having the minimum completion time.[2][3][4] [15][13]

2.3 RASA ALGORITHM

RASA is Resource Aware Scheduling Algorithm it combines Min-Min and Max-Min algorithm alternatively in order to achieve better performance. In RASA resource completion time is calculated and then Min-Min and Max –Min algorithms are applied alternatively.[4]

III. THEORETICAL ANALYSIS

In order compare performance of above two algorithms we have generated 10 tasks and 5 nodes with the following parameter values. [19]

Task	Number of instructions in million
1	105
2	200
3	66
4	123
5	155
6	356
7	459
8	512
9	445
10	635

Table 1: Parameters of Task

Node	Million instruction per second
1	35
2	40
3	45
4	80
5	100

Table 2: Nodes speed

Task	Nodes				
	1	**2**	**3**	**4**	**5**
1	3	2.62	2.33	1.31	1.05
2	3.71	5	4.44	2.5	2
3	1.88	1.65	1.46	0.82	0.66
4	3.51	3.07	2.73	1.53	1.23
5	4.42	3.87	3.44	1.93	1.55
6	10.17	8.9	7.91	4.45	3.56
7	13.11	11.47	10.2	5.73	4.59
8	14.62	12.8	11.37	6.4	5.12
9	12.71	11.12	9.88	5.56	4.45
10	18.14	15.87	14.11	7.93	6.35

Table 3: Completion time of task

IV PROPOSED ALGORITHM MINIMUM MAKESPAN

1. While no more task left
2. Select a task T_k with the maximum makespan in Node N_k.
3. Select a Node N_p such that the task T_k when migrated to $N_p$produces minimum makespan among the all nodes.
4. If two Nodes produces same makespan length for task T_k thenassigned task $T_k$to the node with higher computational resources.

5. Assign task T_k to Node N_p and record the makespan for the node N_p.
6. Remove the task T_k from the list of available task.
7. End while

8. V PERFORMANCE COMPARISON AND RESULT DISCUSSION

Fig 1 : Min-Min Algorithm

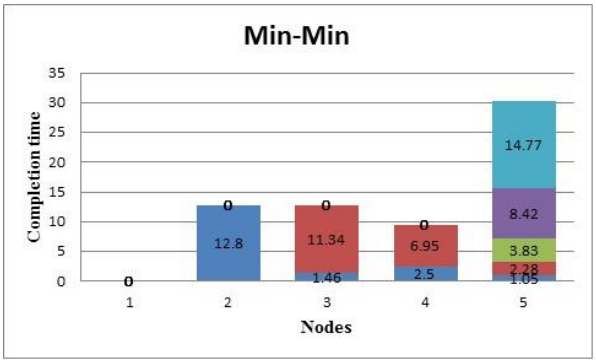


Fig 2 : Max – Min Algorithm

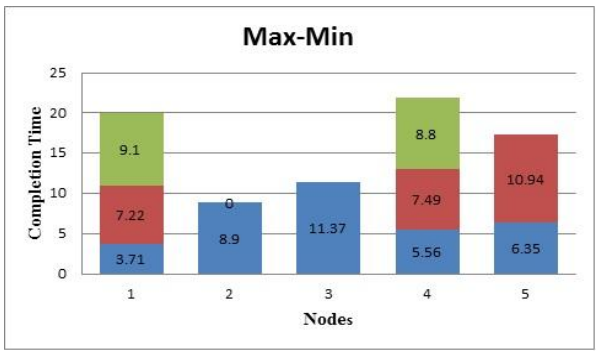


Fig 3. Minimum Makespan

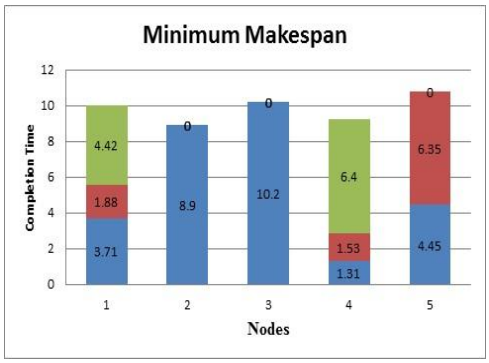


Fig 4. RASA Algorithm

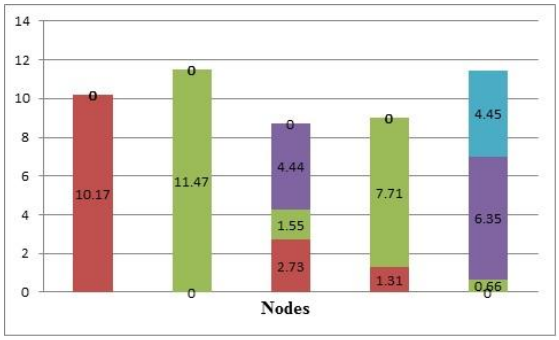
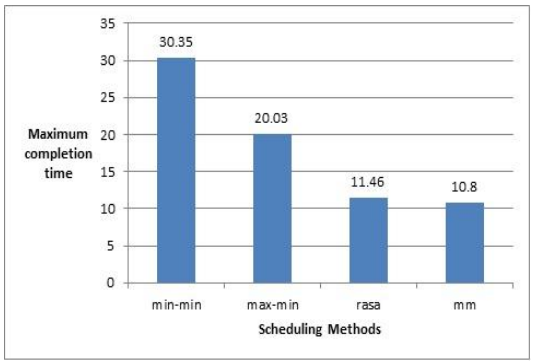


Fig 5. Makespan Comparison



From the above figures the following points are concluded.

(i) The utilization of resources in Minimum Makespan is more than other algorithms..

(ii) Makespan = max (rt_j), Maximum execution time in a node.

Method	Makespan
Min-Min	30.35
Max-Min	20.03
RASA	11.46
MM	10.80

Table 4: Makespan

Average resource utilization (U_a) [4]

$$U_a = \frac{\sum_{i=1}^{N} c_i}{Nm} * 100$$

N = No. Of nodes, m= makespan, c_i = completion time

Algorithm	Resource Utilization (%)
Min-Min	43.09
Max-Min	79.32
RASA	88.72
MM	91.01

Table 5: Resource Utilization Comparison

CONCLUSION

The load balancing aims at the high throughput, high resource utilization and less turnaround time. The paper compares between Min-Min, Max-Min and RASA algorithm and proposed new Minimum Makespan algorithm. The Proposed Minimum Makespan Algorithm gives Minimum make span among the all three scheduling algorithm. As indicated in the Table 4. The Table 5 compares the resource utilization among the above scheduling algorithms. Table 5 shows that Minimum Makespan algorithm produces the high utilization of resources.

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