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A Priority Based Job Scheduling Algorithm in Cloud Computing

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Abstract: Nowadays Cloud Computing has become a popular platform for scientific applications. Cloud Computing intends to share a large scale resources and equipments of computation, storage, information and knowledge. Job scheduling algorithms are one of the most challenging theoretical issues in the Cloud Computing area. In this project we implement a new Priority based job scheduling algorithm (PJSC) in cloud computing. The proposed algorithm is based on multiple criteria decision making model and mathematical model called Analytical Hierarchy Process (AHP). The proposed algorithm provides scheduling with minimum makespan, high throughput and reasonable complexity

Keywords: Cloud Computing, Cloudsim, Scheduling Algorithm.

I. INTRODUCTION

Cloud computing is Distributed Computing paradigm which provides services to the customers. Cloud Providers provide services to their customers and charge as per usage by particular customer. That is, use as much or less you want to use, use services when you want to use and pay for only what you have used. Cloud computing is a construct that allows you to use applications that actually reside on a location different from your machine location. The cloud environment provides a different virtualized platform that helps user to accomplish their jobs with minimum completion time and minimum costs. Figure 1.1 shows the framework of cloud. In the cloud computing model, computing power, software, storage services, and platforms are delivered on demand to external customers over the internet. Cloud makes it possible for users to use services provided by cloud providers from anywhere at any time. The high growth in virtualization and cloud computing technologies reflect the number of jobs that are increasing nowadays, require the services of the virtual machine. To efficiently increase the working of cloud computing environments, job scheduling is one the tasks performed in order to gain maximum profit.

Different types of job scheduling algorithms have been applied on different types of data workloads. And results are measured with different performance parameters to evaluate the performance. Job-scheduling algorithms are developed to accomplish several goals like expected outcome, efficient use of resources, low makespan, high throughput, better quality of service, maintaining efficiency. Traditional job scheduling algorithms like FCFS, Round Robin scheduling algorithm (RR), Min–Min algorithm and Max–Min algorithm are not able to provide scheduling in the cloud environments. Traditional techniques are also called as optimization techniques. These techniques are slow and guarantee for global convergence as long as problems are small. But in cloud computing, the problems are very complex and also we need fast response environments. Thus traditional scheduling cannot guarantee for optimal solution in cloud computing. Several job scheduling algorithms have been proposed in distributed computing area. The main goal of job scheduling is to achieve a high performance computing and the best system throughput.

II. PROPOSED SYSTEM

Priority of jobs is an important issue in scheduling. In cloud environments we always face a wide variety of attributes that should be considered. Priority based job scheduling algorithm is suitable example of On-line mode heuristic scheduling algorithm. A particular job scheduling algorithm in cloud environments should pay attention to multi-attribute and multi-criteria properties of jobs. There are several multi-criteria decision-making (MCDM) and multi-attribute decision-making (MADM) which are based on mathematical modeling. A pair-wise comparison based MADM/MCDM method was developed by T.Saaty in 1980, the model was named Analytical Hierarchy Process (AHP).The main objective of our project is to implement a new priority based job scheduling algorithm called PJSC. The proposed algorithm is based on the theory of AHP.

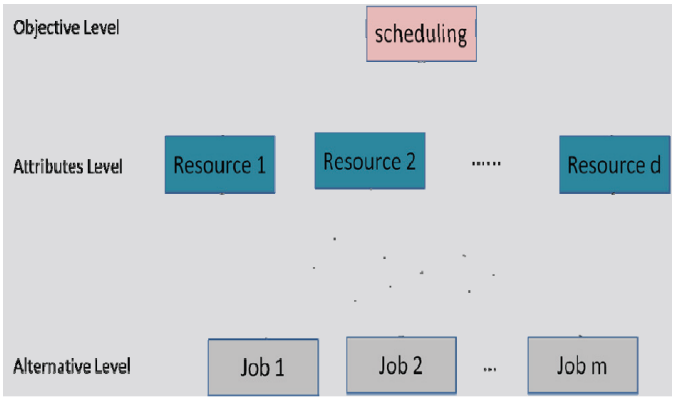

Fig1.

A. Priority based job Scheduling Algorithm (PJSC)

Priority based job Scheduling Algorithm based on The Analytic Hierarchy Process (AHP). The AHP considers a set of evaluation criteria, and a set of alternative options among which the best decision is to be made. The AHP generates a weight for each evaluation criterion according to the decision maker's pairwise comparisons of the criteria. The higher the weight, the more important the corresponding criterion. Next, for a fixed criterion, the AHP assigns a score to each option according to the decision maker's pairwise comparisons of the options based on that criterion. The higher the score, the better the performance of the option with respect to the considered criterion. Finally, the AHP combines the criteria weights and the options scores, thus determining a global score for each option, and a consequent ranking. The global score for a given option is a weighted sum of the scores it obtained with respect to all the criteria. The AHP is a very flexible and powerful tool because the scores, and therefore the final ranking, are obtained on the basis of the pairwise relative evaluations of both the criteria and the options provided by the user. The number of pairwise comparisons grows quadratically with the number of criteria and options. For instance, when comparing 10 alternatives on 4 criteria, 4*3/2=6 comparisons are requested to build the weight vector, and 4*(10*9/2) = 180 pairwise comparisons are needed to build the score matrix.However, in order to reduce the decision maker's workload the AHP can be completely or partially automated by specifying suitable thresholds for automatically deciding some pairwise comparisons.

B. Implementation of Priority based job Scheduling Algorithm

We need to calculate the weight vectors for jobs on each resource. So, we get m number of column weight vectors. Let's be a multi-dimensional matrix containing m column vectors. Thus order of matrix S is nxm (n jobs, m resources).

C. Priority based job Scheduling Algorithm

The proposed algorithm may face with three important issues; complexity, consistency and finish time (makespan).

D. Complexity

The complexity of proposed algorithm is mainly due to computing the priority vectors of comparison matrixes. And it depends on the number of jobs and resources. In the worst case complexity of proposed algorithm can be calculated by

$$\Omega=d^{2.81}+d*m^{2.81}$$

Where, m and d are the number of jobs and resources respectively. In this case, we assume that a matrix multiplication takes approximately $m^{2.81}$ arithmetic operations (additions and multiplications).

E. Consistency

Consistency indicates that each of comparison matrixes has a logically reasonable value. Consistency of proposed algorithm mainly depends on the decision makers, in other word if the decision makers can adjust elements of comparison matrix based on real priority of scheduling they can make a number of consistent comparison matrixes. Consistency can be investigated by above equation of comparison matrixes. Also for investigating the consistency of comparison matrix we should solve above equation. For this purposes we can use some iterative methods. An iterative method also has complexity. If each of the comparison matrixes is not consistent we should make a new comparison matrix again. It increases the complexity of algorithm. So, total complexity of proposed algorithm can be calculated by

$$T_{complexity}=\Omega+C_{complexity}$$

Where x is the complexity of computing, it can be calculated by below equation. k denotes the number of comparison matrixes that rejected (recomputed) because of inconsistency.

$$C_{complexity}= k* \max(m,n)^{2.81}$$

F. Finish Time (makespan)

The proposed algorithm mainly focuses on priority of jobs. However we do not expect this algorithm has optimal finish time (makespan). It means that the algorithm must consider the priority of jobs instead of considering the finish time (makespan).

Algorithm for PJSC :

Enter J= {j1,...,jm } a set of jobs .
For all jobs make consistent pair-wise comparisons and form a matrix, A.
Compute priority vector for jobs and name it as ω.
Calculate Consistency Index for the matrix A.
Calculate Consistency Ratio, C
a)ifCR<=0.1,goto6 else goto 2.

Choose a job with maximum amount of priority value based on ω.
Update the list of jobs.
End.

III. RELATED WORK

Traditional job scheduling algorithms like FCFS, Round Robin scheduling algorithm (RR), Min–Min algorithm and Max–Min algorithm are not able to provide scheduling in the cloud environments. Traditional techniques are also called as optimization techniques. These techniques are slow and guarantee for global convergence as long as problems are small. But in cloud computing, the problems are very complex and also we need fast response environments. Thus traditional scheduling cannot guarantee for optimal solution in cloud computing. Several job scheduling algorithms have been proposed in distributed computing area. The main goal of job scheduling is to achieve a high performance computing and the best system throughput.

IV. CONCLUSION

Priority is an important issue of job scheduling in cloud environments. In this project we have proposed a priority based job scheduling algorithm which can be applied in cloud environments. Experimental result of this algorithm indicates that the proposed algorithm has reasonable complexity. We have implemented this algorithm on a single resource and all the output shows that algorithm worked well. In addition, deterministic value for finish time (makespan) of PJSC cannot be calculated. It depends on the priory of jobs and may change from the worst value to the best value. Increasing the number of resources introduces a new concept called load

balancing. To run PJSC with multiple resources is considered as future work. Improving the proposed algorithm in order to gain a reasonable and less finish time is also considered as future work.

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