

CHAPTER 4

ENERGY EFFICIENT HEURISTIC SCHEDULING FOR DATA INTENSIVE APPLICATIONS IN CLOUD COMPUTING

4.1 OVERVIEW

When heuristic approaches are compared to other class of traditional algorithms, in the way of operating and problem solving then heuristics always find nearly optimal solutions efficiently thereby enhancing the performance in cloud computing environment. The focus of this chapter yields to designing an energy efficient heuristic approach for scheduling data-intensive applications in cloud computing. The Chapter covers introduction to heuristic algorithms followed by concept of energy efficient heuristic approach and finally covering summarization of the chapter.

4.2 INTRODUCTION

Heuristic algorithms are advanced and can apply to the complex problems as these contain less time complexity. Heuristics can produce competitive results not only on well-known NP-complete problems, but on any computational problem for which precise algorithms require prohibitive time. Besides computer science, heuristic algorithms are also subject of intensive research in other fields of computational domains (e.g. operations research, bio-informatics, and engineering) in which one routinely needs to solve computational optimization problems. Proficient job scheduling is crucial to achieving high performance in cloud computing environment. The below Figure 4.1 shows classification of heuristic job scheduling algorithm [86]:

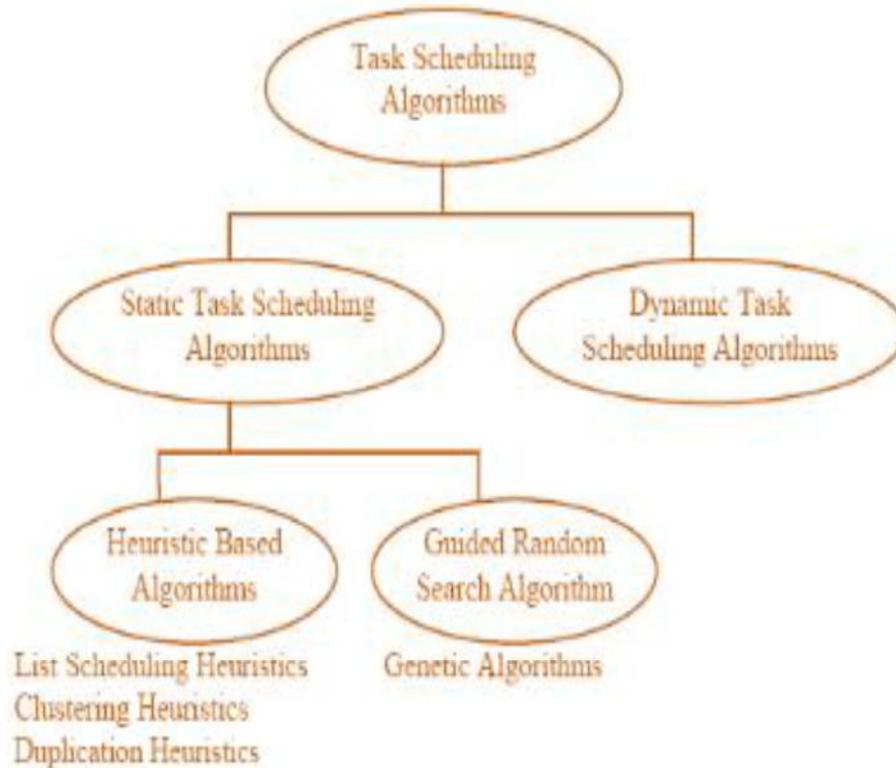


Figure 4.1: Classification of Heuristic Job Scheduling Algorithms [86]

Implementations of heuristic based algorithms are done in several ways. In List Scheduling Heuristic, a priority is fixed to each task is then added to a queue of waiting tasks in order of decreasing priority. As soon as the processors become available, the task on the top of priority list is deleted from the queue and assigned to the most suited processor. The major difference between algorithms in this category is the way by which priorities are assigned and the most suited processor is allocated. In clustering heuristic, mapping of the tasks of a given task graph is done into an unlimited number of clusters [86].

In this heuristic, each iteration refines the previous clustering by merging some clusters. If two tasks are assigned to the same cluster, they will be executed on the same processor. In duplication based heuristic, scheduling of a task graph is done by mapping some of its task redundantly, which reduces the inter process communication over head [86].

4.3 ENERGY EFFICIENT HEURISTIC APPROACH

In cloud, users may submit multiple jobs to scheduler for processing at same time, so at times it becomes difficult to schedule these user jobs manually. To combat this there is an need of effective framework to schedule the cloud user jobs according to the user preferences and the user satisfaction. Scheduling decides about the start and end of the activity. The various decisive factors for scheduling depend upon the duration, predecessor activity and relationship, resource availability and target completion time. Generic issues in scheduling consists fair resource allocation, service quality, energy consumption, load balancing, increasing response time and so on places a vital role in cloud computing.

Cloud computing is experiencing an increase in number of users every day One of the main reasons for the increase in number is it's highly user oriented, hence it should be scalable for the different number of users and user preferences. For each job, framework of scheduling should align efficiently, so energy efficiency also places a crucial role in job scheduling [107].

Optimal scheduling of cloud user jobs in cloud computing background has been proved NP complete problem, so there is a need of application of heuristic methods. Various heuristic algorithms have been proposed and used to solve this problem, but applying proper algorithm for solving job assignment problem of a particular nature is difficult as these methods are developed under different assumptions.

Energy consumption and resource utilization in clouds are highly coupled. The reason for this extremely high energy consumption is not just the quantity of these computing resources and the power inefficiency of hardware, but rather lies in the inefficient usage of these resources.

The energy consumption shows a direct association and a linear relationship with the utilization of resources. To Achieving the optimized energy consumption in a deadline-constrained cloud environment implementation of a heuristic based algorithm is advocated to minimize energy consumption while also observing constrained average job response times. Our advocated heuristic based algorithm

allocates each jobs to the resources on which the energy consumption for executing the jobs is explicitly or implicitly minimized without the performance degradation of that jobs and hence increasing performances of cloud environment.

4.3.1 Heuristic Approach Based Upon the Concept of Multi Queue Scheduling Using Two Queues

It is well known that high-quality service and fair competition are the foundation for commercial operations. In cloud computing, the provider needs to face a variety of jobs from different cloud users. With the number increase of users, cloud-scale expansion the key issues of cloud computing are to ensure the effective job scheduling and provide equitable opportunity for the use of resources for diverse cloud users so as to minimizing the energy consumption and providing least completion time and so on.

In this research work efforts has been made in designing a job scheduling heuristic job scheduling approach for a cloud computing system which optimizes the energy consumption. The scheduler of proposed job scheduling heuristic approach is dissimilar to previously presented scheduler [65] in the following way i.e. firstly in [65] the heuristic approach developed by the authors divides cloud user jobs into three queues while in proposed approach the jobs will be divided in two queues instead of three queues; secondly strategy adopted for selecting user jobs from the different queues and allocating them to virtual resources for execution is different for proposed heuristic approach as compared to heuristic strategy adopted in [65].

4.3.2 Heuristic Approach for Optimal Job Processing Avoiding Dynamic Selection

During the cloud user jobs execution, the virtual resources get allocated user jobs. The mapping of jobs to VMs is one-to-one. The advocated scheduling framework proposed in this research work have various advantage over the dynamic selection of user jobs as addressed in [65] because in proposed strategy of this research work; scheduler by forms merge pattern by merging the cloud users jobs from both the queues and then allocating these set of merge pattern (which contains user jobs from

both the queues) on the different virtual machines existing in the cloud network by detecting the status of each virtual machine , that will outcome in reducing the energy consumption and as users will spend fewer time in the queues so the waiting time will reduce simultaneously so as the job completion time.

4.3 SUMMARY

In this chapter discussion is done on the purpose of heuristic algorithm, as they search for a solution near to the best one and they find it fast and easily. In this research a heuristic based algorithm is proposed which works on principal to minimize energy consumption and improving execution time in the cloud environment. The Chapter 5 discusses about the proposed smarter multi queue job scheduling (SMQS) algorithm in detail.