THESIS ORGANIZATION

Chapter 1: Introduction to the Cloud computing paradigm

This chapter systematically explores the cloud computing paradigm by providing insight to the various challenges in providing services to the users. The chapter explores the different services like Infrastructure as service, Platform as a Service and Software as a service provided to the users. The components involved in providing these services are explored and presented as a high-level architecture in this chapter. The High level architecture presents layered view of the components along with the security requirements and challenges at different layers related to components of the individual layers. The chapter further exploits many challenging areas in particular, task scheduling aspects in cloud computing environment.

Chapter 2: Modeling of multi-objective Task scheduling problem in cloud computing environment

This chapter provides precise elucidation of task scheduling problem, algorithms, and its complexity class. It also provides the Interpretation of task scheduling problem in the context of cloud computing environment. The scheduling algorithms currently prevalent in clouds are summarized and metrics considered by these algorithms are tabulated. Based on the observations an economic-based multi-objective mathematical model for simultaneous task scheduling and utilities minimization is designed. The framework is based on Pareto optimality theory and realizes the optimal allocation of Cloud resources. The model in particular based on execution cost, migration cost, operational cost, down time cost and communication cost. The objective of the task scheduling problem is to minimize the total cost.

Chapter 3: Literature survey: Metaheuristic methods for task scheduling

Traditional methods used in optimization are deterministic, fast, and give exact answers but often tends to get stuck on local optima. Complexity class of the task scheduling problem belongs to NP-complete involving extremely large search space with correspondingly large number of potential solutions and takes much longer time to find the optimal solution.
There is no readymade and well defined methodology to solve the problems under such circumstances. However in cloud, it is sufficient to find near optimal solution, preferably in a short period of time. In this context IT practitioners are focusing on heuristic methods. This chapter presents classification of various schedulers used in Cloud environment. The main focus is on metaheuristic methods such Genetic Algorithms (GA), Ant Colony Optimization (ACO) and Particle Swarm Optimization (PSO).

**Chapter 4: Design of Genetic Algorithm for Task scheduling**

Task scheduling problem is of paramount importance which directly relate to the efficiency of the cloud computing system. Many task scheduling problem studies have been conducted in the past. However, the objective of most of these has been the minimization of the make span. In the real world, there exist other objectives, such as minimization of total cost of that might help improve efficiency.

Genetic Algorithms are good at taking larger, potentially huge search spaces and navigating them looking for optimal combination of things and solutions which we might not find in a life time. GA has certain advantages, including simple structure, easy implementation, short search time, and robustness. However, there has been limited study of GA to address the multiple objectives found in the task scheduling problem. Therefore in this chapter we have presented a GA based method which makes a scheduling decision by evaluating the entire group of tasks in the job queue. The initial sections of the chapter describe the design of a genetic algorithm, how initial chromosome is designed, how variables in GA are encoded and how fitness function is calculated. Implementation details are explained by taking a problem instance. Metrics of comparison, experimental data, results, result analysis and the conclusion is explained in subsequent sections.

**Chapter 5: Design of Ant colony Optimization algorithm for task scheduling**

This chapter deals with the design of an Ant Colony Optimization (ACO) algorithm that aims to allocate tasks on to available resources in cloud computing environment. ACO is a meta-heuristic approach applied successfully to single objective combinatorial problems. This chapter examines the concepts involved in the design of ACO algorithms to tackle Multi objective Task scheduling problem such as defining multi objective pheromone information, calculation of probability matrix and pheromone update strategies.
Chapter 6: Particle Swarm Optimization methods and performance evaluation

Particle Swarm Optimization (PSO) is a powerful optimization algorithm. This chapter presents the overview of Particle Swarm Optimization. Emphasis is on PSO to explore the possible use of various algorithms such as Standard PSO, Synchronous PSO and Asynchronous PSO. This chapter also describes the Graphical Processing Units (GPU) based PSO implementations on CUDA architecture. The performance of asynchronous PSO is compared with synchronous and standard PSO.

Chapter 7: Design of Particle Swarm Optimization Algorithm for task scheduling

This chapter presents the design of particle swarm optimization algorithm for task scheduling in cloud computing environment. The PSO heuristic is used to minimize the total cost of placement of tasks on available resources. Total cost values are obtained by varying the communication cost between resources, task dependency cost values, and the execution cost of compute resources. Finally the results obtained from PSO algorithm are compared with ACO.

Chapter 8: System architecture and Result analysis

In this chapter, we develop a system framework for assignment of batch of tasks on to resources in cloud computing environments. Experimental set up is explained by setting initial parameters for GA, ACO and PSO metaheuristics. The results are compared in terms of total cost based allocation of tasks and number of resources required to assign tasks.

Chapter 9: Conclusion and Future Scope

This chapter concludes and indicates future research directions.