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REVIEW

A review of metaheuristic scheduling techniques in cloud computing

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Abstract Cloud computing has become a buzzword in the area of high performance distributed computing as it provides on-demand access to shared pool of resources over Internet in a self-service, dynamically scalable and metered manner. Cloud computing is still in its infancy, so to reap its full benefits, much research is required across a broad array of topics. One of the important research issues which need to be focused for its efficient performance is scheduling. The goal of scheduling is to map tasks to appropriate resources that optimize one or more objectives. Scheduling in cloud computing belongs to a category of problems known as NP-hard problem due to large solution space and thus it takes a long time to find an optimal solution. There are no algorithms which may produce optimal solution within polynomial time to solve these problems. In cloud environment, it is preferable to find suboptimal solution, but in short period of time. Metaheuristic based techniques have been proved to achieve near optimal solutions within reasonable time for such problems. In this paper, we provide an extensive survey and comparative analysis of various scheduling algorithms for cloud and grid environments based on three popular metaheuristic techniques: Ant Colony Optimization (ACO), Genetic Algorithm (GA) and Particle Swarm Optimization (PSO), and two novel techniques: League Championship Algorithm (LCA) and BAT algorithm.

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1. Introduction

Scheduling allows optimal allocation of resources among given tasks in a finite time to achieve desired quality of service. Formally, scheduling problem involves tasks that must be scheduled on resources subject to some constraints to optimize some objective function. The aim is to build a schedule that specifies when and on which resource each task will be executed [1]. It has remained a topic of research in various fields for decades, may it be scheduling of processes or threads in an operating system, job shop, flow shop or open shop scheduling in production environment, printed circuit board assembly scheduling or scheduling of tasks in distributed computing systems such as cluster, grid or cloud.

In recent years, distributed computing paradigm has gained much attention due to high scalability, reliability, information sharing and low-cost than single processor machines. Cloud computing has emerged as the most popular distributed computing paradigm out of all others in the current scenario. It provides on-demand access to shared pool of resources in a self-service, dynamically scalable and metered manner with guaranteed Quality of service to users. To provide guaranteed Quality of Service (QoS) to users, it is necessary that jobs should be efficiently mapped to given resources. If the desired performance is not achieved, the users will hesitate to pay. Therefore scheduling is considered as a central theme in cloud computing systems.

In general, the problem of mapping tasks on apparently unlimited computing resources in cloud computing belongs to a category of problems known as NP-hard problems. There are no algorithms which may produce optimal solution within polynomial time for such kind of problems. Solutions

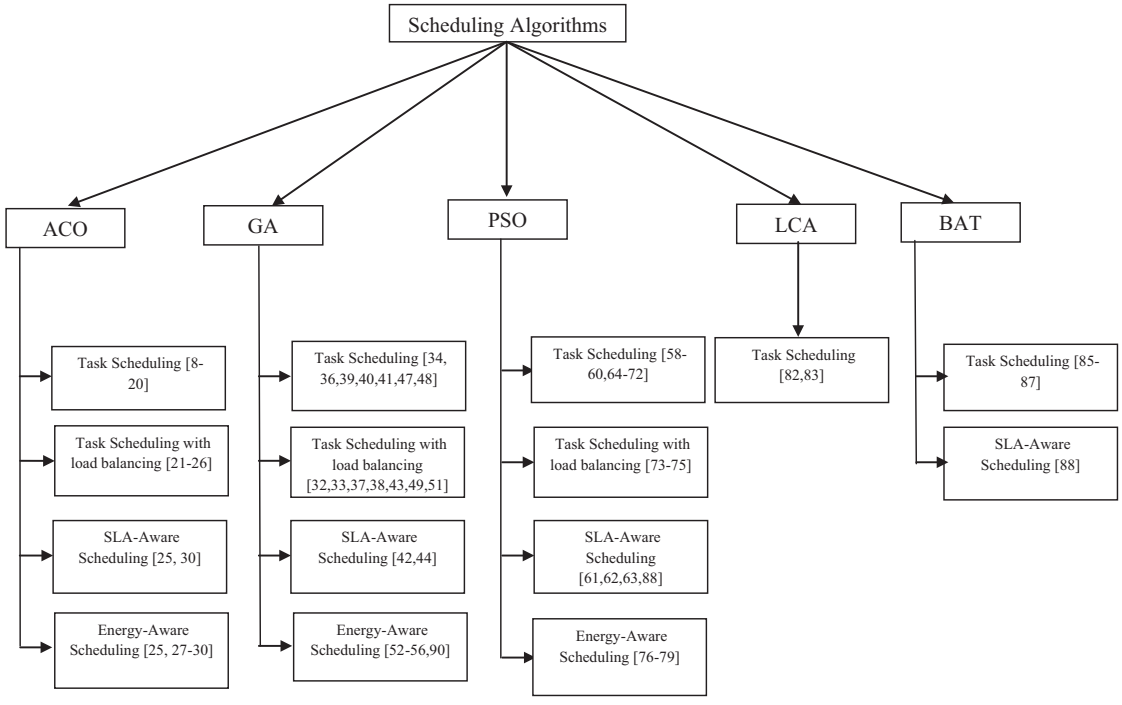

Figure 1 A general framework of the paper.