



# On scheduling transaction in grid computing using cuckoo search-ant colony optimization considering load

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## Abstract

Scheduling of transactions in the grid computing system is known to be an NP-hard problem. In order to solve this problem, this paper introduces a hybrid approach named cuckoo search-ant colony optimization. The approach is to dynamically generate an optimal schedule by clustering the resources considering their load so as to complete the transactions within their deadlines as well as utilizing the resources in an efficient way. The approach also balances the load of the system before scheduling the transactions. We use cuckoo search method for making clusters of resources based on their load. We use ant colony optimization for selecting the appropriate and optimal resources. We evaluate the performance of the proposed algorithm with six existing algorithms. The results illustrate that an important advantage of the cuckoo search-ant colony optimization algorithm is its speed of clustering and ability to obtain faster and feasible load balanced schedules.

**Keywords** Transaction scheduling · Grid computing system · Ant colony optimization · Cuckoo search

## 1 Introduction

A grid computing system is a large scale, heterogeneous, autonomous, and geographically distributed in which all the nodes are interconnected by low latency and high bandwidth network [19]. Transactions have a peculiar nature in terms of their computation operation and their completion on various distributed nodes in the grid computing system, and hence scheduling of transactions in this system deserves special attention. Load balanced

transaction scheduling problem [33–35, 35–40, 40–45] consists in determining the load balanced node where a specific transaction is to be executed within its deadline.

A grid transaction is a group of operations that are executed to perform some specific functions by accessing and/or updating a database [59]. In grid computing system, the transaction is composed of various service calls executed by different peers of the grid [58]. It is widely needed as an effective means by sharing a large number of resources [55–57]. It arrives at any node and may execute at several nodes in the grid system before its completion within its deadline. Due to its dynamic arrival nature to the system, some nodes of the system are heavily loaded while others are lightly loaded. Consequently, the waiting time of the transactions increases [22] causing delay in their execution. To get the optimal solution of the problem, a load balanced transaction scheduling is required.

In this paper, we extend our previous work [45] where all of the nodes are searched by using ant colony optimization method. The solution would be easier if the nodes are divided into clusters based on load and then the optimization algorithm is applied. Therefore, it is desirable to explore other avenues for developing good heuristic algorithms along with clustering approach. In this paper we

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