

Resource Management Approaches Based on Nature Inspired Algorithms in Cloud Computing

K.P.N. Jayasena^a and Lin Li^b

^a *Department of Computing and Information Systems, Faculty of Applied Sciences,
Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka*

^b *School of Computer Science and Technology, Wuhan University of Technology, PR China
pubudu@appsc.sab.ac.lk*

Cloud computing is an emerging computing platform with flexible computational architecture and an enormous collection of heterogeneous systems. Resource management is an important strategy in enhancing the overall performance of cloud computing. Currently, effective resource management in cloud computing is becoming an inevitable demanding topic and it is very challenging to implement efficient resource management based on QoS demands by optimizing the number of objectives. In this research, resource management problem can be considered from three optimization aspects: single objective optimization, multi-objective optimization and many objective optimizations. We discuss two significant levels in this emerging resource management paradigm: one is task scheduling, that maps tasks to VMs and the other is VM placement, which maps VMs to physical servers. The nature inspired algorithm approaches can obtain feasible solutions than others. Firstly, this research explores the research in the area of resource management in cloud computing to gain an understanding of related work. Secondly, this research proposes single-objective efficient resource management and task scheduling methods in cloud platforms to minimize response time, makespan and data center processing time. Another main target of the thesis is to research multi-objective energy aware, efficiency aware and QoS aware resource management as VM placement mechanism for simultaneously optimizing three objectives. Most of the previous research methods, either single objective or multi-objective, cannot provide suitable solutions when the number of the objectives exceeds three. Therefore, there is a tremendous demand to use the many-objective optimization mechanism to deal with the resource-management problem. Finally, this research proposes a many-objective approach for VM placement to attain equilibrium among five objectives. In summary, we propose energy aware, efficiency aware, cost aware, QoS aware load balancing and utilization aware resource scheduling approaches in cloud computing using nature-inspired algorithms. The performance evaluation from three optimization aspects, i.e., single-objective, multi-objective and many-objective optimizations, demonstrate that the proposed approaches are capable of enhancing the state-of-the-art techniques in the environment of enormous cloud data centers by optimizing different objective functions.

Keywords: resource management, task scheduling, VM placement, multi-objective optimization, many-objective optimization