PROPOSED MODEL FOR MULTI-OBJECTIVE DIFFERENTIAL EVOLUTION (MODE) IN CLOUD COMPUTING

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ABSTRACT

In modern world Cloud Computing is one of the most promising and evolving areas of computer science. Cloud is developing day by day and faces many challenges, one of them is scheduling. Scheduling is a technique which is used to improve the overall execution time of the job. Scheduling in cloud is responsible for selection of best suitable resources for task execution, by taking some parameters into consideration. Efficient scheduling should be provided so that both the user and the service provider gain profit. In this paper, the researcher presents the proposed model for multi-objective differential evolution (MODE) algorithm to optimize task scheduling based on energy and makespan.

Keywords — *Cloud Computing, Differential Evolution (DE), Minimize Energy and Makespan, Multi-objective optimization, Task Scheduling*

1.INTRODUCTION

There is no exact definition of cloud but we can define cloud in various ways and by considering various means. Cloud computing is Internet-connected mode of supercomputing. It is a type of shared infrastructure, which simply puts the huge system pools together by using various means; distributed, virtualization etc. It gives users a variety of storage, networking and computing resources in the cloud computing environment via Internet, users put a lot of information and accesses a lot of computing power with the help of its own computer.

According to R.Buyya that defines the cloud as " Cloud is a parallel and distributed computing system which basically consist of a collection of inter-connected and virtualized computers that are provisioned dynamically and presented as one or more than one unified computing resources based on service-level agreement (SLA) established through negotiation between the service providers of cloud and users [1].

Cloud computing is a large-scale distributed computing model, which depends on the economic size of the operator of cloud that is abstract, virtualized and dynamic. The main content of cloud computing is to manage computing power, storage, various kind of platforms and services which assigned to the external users on demand through the internet. Cloud computing is a rapidly emerging computation paradigm with the goal of freeing up users of cloud from the management of hardware, software, networks and data resources and shifting these burdens to cloud service providers[2]. Clouds provide a very large number of resources, including platforms for computation, data centers, storages, Networks, firewalls and software in form of services. At the same time it also provides the ways of managing these resources such that users of cloud can access them without facing any kind of performance related problems.

Cloud service is divided into three models [3] that are discussed below. They are,as shown in Fig. 1

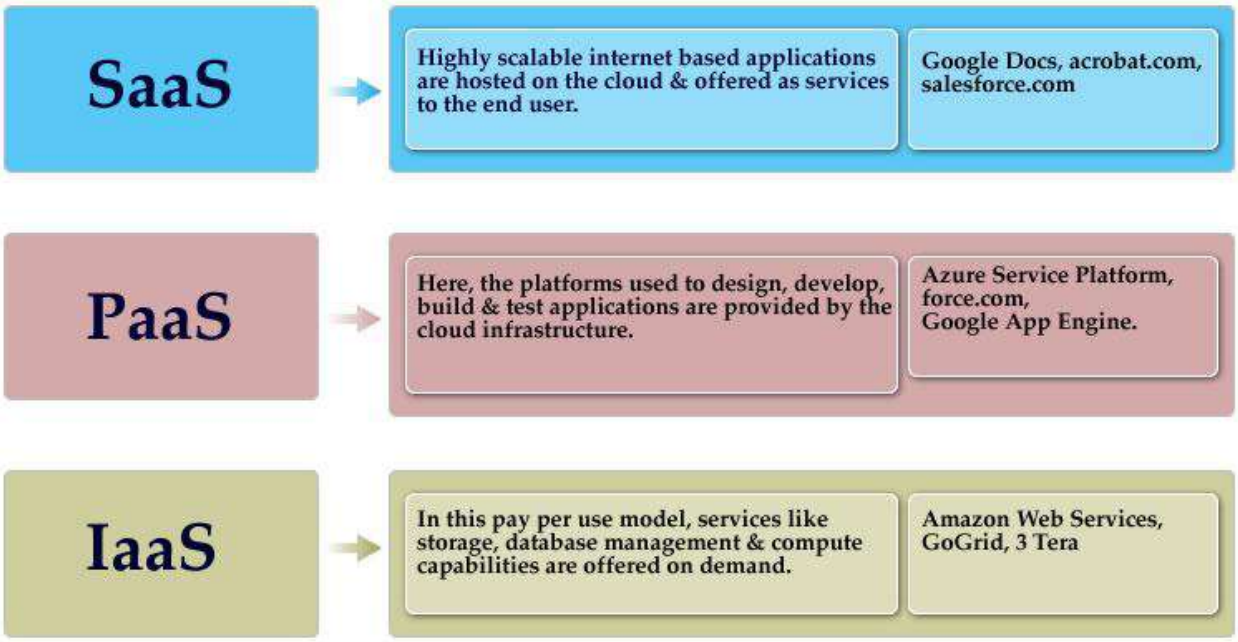

Fig 1: Service Models of Cloud Computing [3]

- **Software as a service (Saas):** The competence provided to the consumer is to make use of the provider's applications consecutively running on a cloud communications. The applications are easy to get from several client devices throughout a thin client interface such as a web browser. The consumer does not deal with the fundamental cloud infrastructure.

- **Platform as a Service (Paas):** The capability provided to the consumer is to arrange on the cloud communications consumer formed or obtained applications created by means of programming languages and tools sustained by the provider. The consumer does not supervise or control the fundamental cloud structure, but has control over the applications and perhaps application hosting environment configurations.

- **Infrastructure as a Service (Iaas):** The capability provided to the consumer is to stipulation processing, storage space, networks, and other basic computing resources where the consumer is capable to deploy and run random software, which contains operating systems and applications. The consumer does not control the underlying cloud communications but has control over operating systems, deployed applications, storage and perhaps limited control of select networking components.

2. INTRODUCTION TO TASK SCHEDULING

Cloud consists of a number of resources that are different with one other via some means and cost of performing tasks in cloud using resources of cloud is different so scheduling of tasks in cloud is different from the traditional methods of scheduling and so scheduling of tasks in cloud need better attention to be paid because services of cloud depends on them. Task scheduling plays a key role to improve flexibility and reliability of systems in cloud. The main reason behind scheduling tasks to the resources in accordance with the given time bound, which involves finding out a complete and best sequence in which various tasks can be executed to give the best and satisfactory result to the user. In cloud computing, resources in any form i.e. cups, firewall, network are always dynamically allocated according to the sequence and requirements of the task, subtasks. So, this leads task scheduling in cloud to be a dynamic problem means no earlier defined sequence may be useful during processing of task. The reason behind the scheduling to be dynamic is that because flow of task is uncertain, execution paths are also uncertain and at the same time resources available are also uncertain because there is a number of same time. The scheduling of

tasks in cloud means choose the best suitable resource available for execution of tasks or to allocate computer machines to tasks in such a manner that the completion time is minimized as possible. In scheduling algorithms list of tasks is created by giving priority to each and every task where setting of priority to different tasks can be based on various parameters. Tasks are then chooses according to their priorities and assigned to available processors and computer machines.

2.1 Scheduling Process

Scheduling process [4] in cloud can be generalized into three stages namely–

- **Resource discovering and filtering –** Datacenter Broker discovers the resources present in the network system and collects status information related to them.

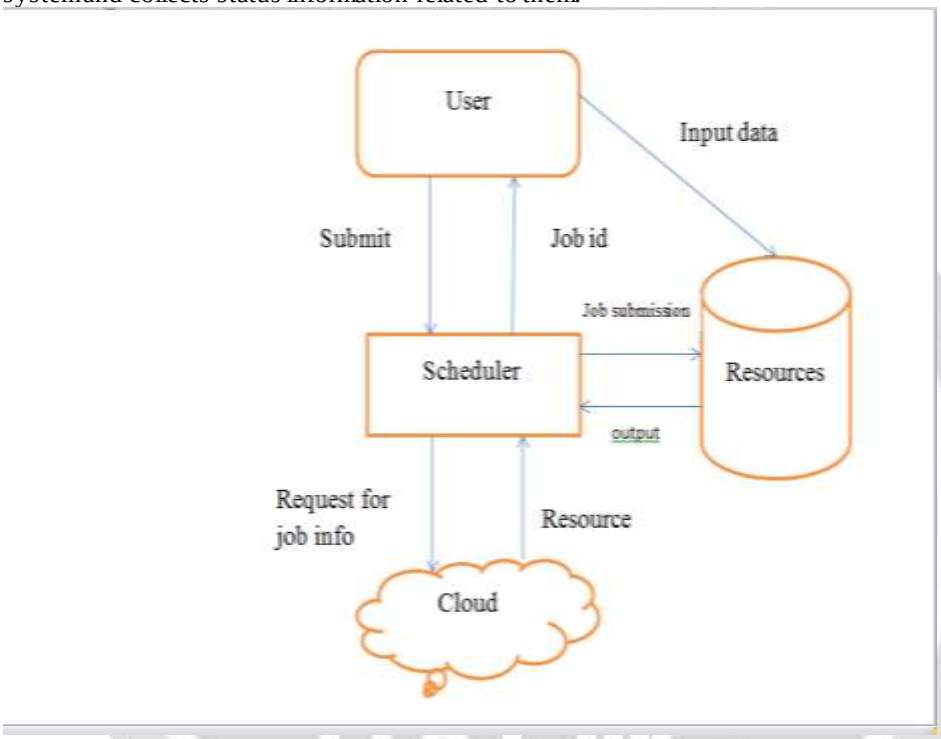

Fig 2: Scheduling Process [4]

- **Resource selection –** Target resource is selected based on certain parameters of task and resource. This is deciding stage.
- **Task submission -**Task is submitted to resource selected.

3. RELATED WORK

R. Durga Lakshmi and N Srinivasu [4] performed comparative study of the different algorithms for their suitability, feasibility, adaptability in the context of cloud scenario, parameters, description, advantages etc.Task scheduling is one of the most famous problems in cloud computing so; there is always a chance of modification of previously completed work in this particular field. In this paper various scheduling algorithms new namely A Genetic Algorithm(GA) based Load Balancing Strategy for Cloud Computing, A Dynamic Optimization Algorithm for Task Scheduling in CloudEnvironment, An Greedy-Based Job Scheduling Algorithm in Cloud Computing etc. have been studied and analyzed. R.K. Jena [5] focused on task scheduling using a multi-objective nested Particle Swarm Optimization (TSPSO) to optimize energy and processing time. The experimental results illustrated that the proposed method multi objective particle swarm optimization (MOPSO) outperformed the BRS and RSA. Yogita Chawla and Mansi Bhonsle [6] studied the conventional scheduling concepts to merge them to provide solution for better and more efficient task scheduling which is beneficial to both user and service provider. The proposed

scheduling approach in cloud employs a dynamically optimized cost-based task scheduling algorithm for making efficient mapping of tasks to available resources in cloud. It aims to combine cost based task scheduling beneficial to user and dynamically optimized resource allocation strategy beneficial to service provider. It also improves computation/communication ratio and utilization of available resources by grouping the user tasks before resource allocation. In this paper [7], the author designed a model to minimize the switching time, improve the resource utilization and also improve the server performance and throughput. This method or protocol is based on scheduling the jobs in the cloud and to solve the drawbacks in the existing protocols. Here the researcher assign the priority to the job which gives better performance to the computer and try my best to minimize the waiting time and switching time. Best effort has been made to manage the scheduling of jobs for solving drawbacks of existing protocols and also improvise the efficiency and throughput of the server. Vu Truong [8] discussed two modern optimization methods including Particle Swarm Optimization and Differential Evolution are compared on twelve constrained nonlinear test functions. Generally, the results show that Differential Evolution is better than Particle Swarm Optimization in terms of high-quality solutions, running time and robustness.DE-2 is better than PSO-2 in terms of solution quality, running time and chance of reaching the best solutions in a variety of problems. In the other hand, number of code lines of PSO-2 is the least. In the author's viewpoint, the best method for the twelve test functions is DE- 2. It is also worth noting that this conclusion is based on results of test functions which cover a variety of types such as linear, quadratic, polynomial and general functions; with given parameters and the constraint handling techniques associated with the algorithms. Lizheng Guo and Azade Khalili et al [9][10] presented the task scheduling optimizing method in cloud computing to minimize the cost and makespan of the problem and solved it by PSO algorithm.

3.1 PROPOSED MODEL OF MODE (Multi-objective Differential Evolution)

Differential Evolution (DE) is a vector population based stochastic optimization method which has been introduced in 1995 by Storn and Price [5] for optimization issues over an ongoing region. It creates new candidate solutions (called agents) by combining the parent individual and several other individuals of the same population. These agents are moved around in the search-space by using mathematical formulae to combine the positions of existing agents from the population. If the new position of an agent is improved than it is accepted and forms part of the population, otherwise the new position is easily throw away. The series of action is repetition until achieve the results and by doing so it is hoped, but not guaranteed, that a satisfactory solution will eventually be discovered. This is a greedy selection scheme that often outperforms traditional EAs (Evolutionary Algorithms).

A.) Differential Evolution for Multi-objective Optimization(MODE) Pseudo Code

Step 1: Random initialization of agents in the parent Population.
Step 2: If stopping criteria is not met than do
2.1 For each agent from Population repeat until condition is not met
(a) Create Candidate from parent.
(b) Evaluate the Candidate fitness values.
(c) If Candidate is pareto optimal than Candidate replaces the Parent.
(d) If Parent is pareto optimal than the Candidate is discarded.
Otherwise,Candidate is added into the Population.

Candidate Creation

Step1: Randomaly select three individuals from Population.
Step2: Calculate Candidate C as
C = Population of of first individual + F . (Population of second individual – Population of third individual)
Where F is scaling factor.
Step3: If Candidate is pareto optimal than modify the candidate by binary crosover with the parent using crossover probability.

When applying DE to MO's, the user tackle with many difficulties. Besides preserving a uniformly spread in ahead of nondominated answers, which is a demanding duty for any MOEA (Multi-objective Evolutionary Algorithm), the

author has to deal with another query, that is, when to replace the parent with the candidate solution. In single-objective optimization, the determination is very easy the candidate replaces the parent only when the candidate is superior to the parent. In MOPs, on the other hand, the decision is not so straightforward. We could use the concept of dominance (the candidate replaces the parent only if it dominates it), but this would make the greedy selection scheme of DE even greedier. The candidate replaces the parent if it dominates it. If the parent dominates the candidate, the candidate is discarded. Otherwise (when the candidateand parent are nondominated with regard to each other), the candidate is added to the population. This step is repeated until popSize number of candidates are created. If the population has enlarged than truncate it, to prepare it for the next step of the algorithm.

(B) Flow Chart of Proposed Model

In figure 3 shows the execution process steps of Differential Evolution (Proposed Model) in a flow chart form. By using diagrams the user can easily understand the model.

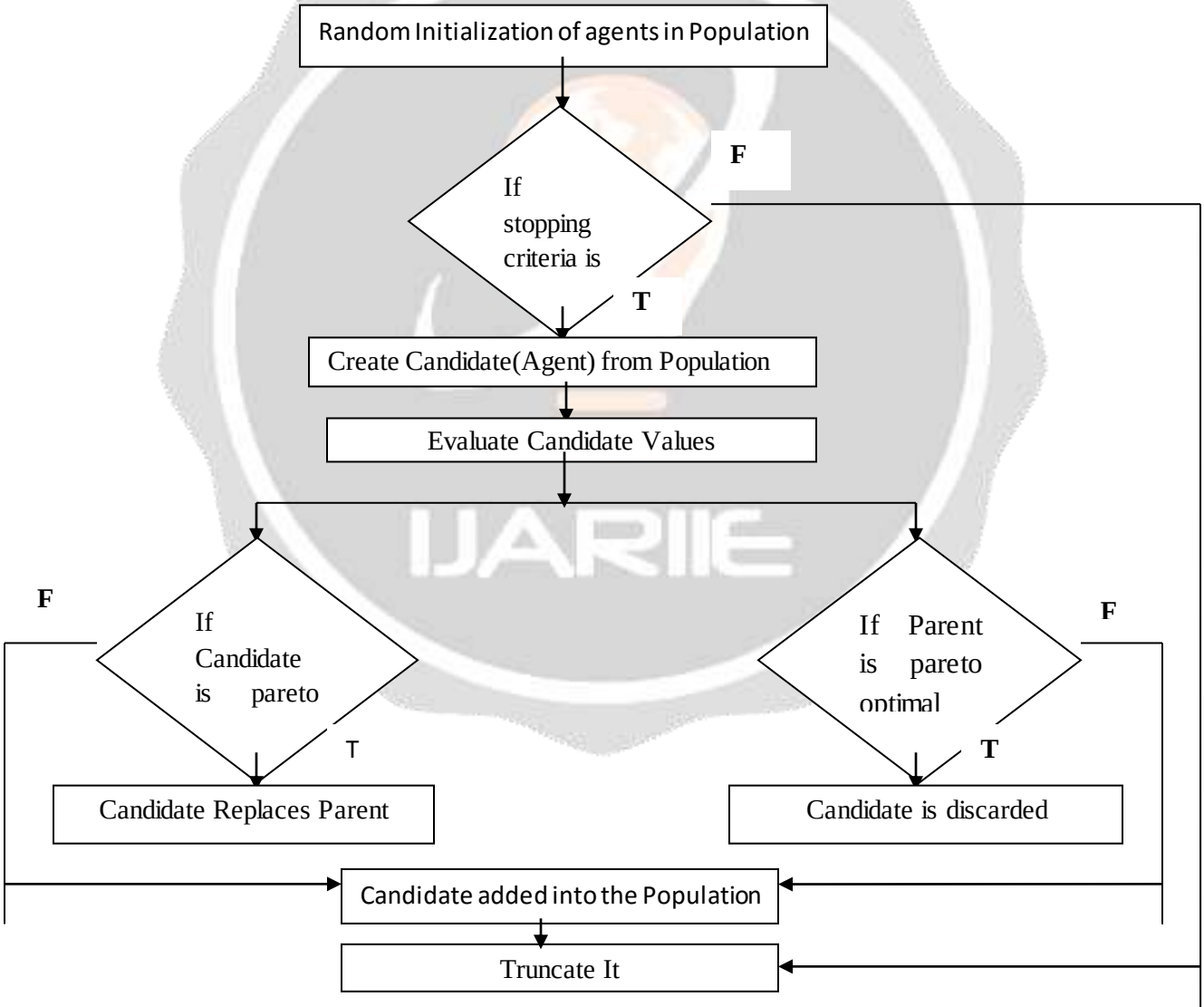

Fig 3: Proposed Model Flow Chart

5. CONCLUSION AND FUTURE SCOPE

Scheduling of task in cloud environment is very challenging issue in cloud computing. In today's time to meet thousands of user requests while making best possible use of available resources as well as fulfill the both user and service provider request, it is challenge for task scheduler. In this paper, the author presents the proposed model of Multi-objective Differential Evolution for task scheduling in cloud environment. In future research, the researcher will implement the proposed model for finding the optimal solution of submitted tasks while trying to minimize the makespan and energy.

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