Improvement in Resource Optimization of Composite SaaS using Genetic Algorithm

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Abstract— Nowadays, Software as a Service (SaaS) is gaining more attention from Software users and providers which is challenging to SaaS Providers for providing better SaaS. For betterment of users, SaaS providers offers SaaS with flexible functions at a lower cost in which SaaS providers focuses on decomposition of SaaS functionalities. That is called the Composite SaaS. In this, we need to determine that how resource optimization performed so that all the virtual machines having their resources. For that we proposed a model which uses the concept of Genetic Algorithm. This paper shows that how resource optimization done using Genetic Algorithm.

Key words: Resource Optimization, Genetic Algorithm, Composite SaaS, Cloud Computing

I. INTRODUCTION

Now in today's environment, cloud computing is become a fastest growing technology in the IT world which provides services over the internet. Cloud computing mainly provides three types of services: (1) Infrastructure as a Service (IaaS) which offers computing infrastructure of user's computing and storage problems in the form of solution. Examples of IaaS are Amazon web service, Cisco Metapad, Microsoft Azure. (2) Platform as a Service (PaaS) which provides the platform for application developers. It provides that platform for developers in which they can design, develop and test their activities using different cloud platforms. Examples of PaaS are Google App Engine, Heroku, Red Hat's OpenShift. (3) Software as a Service (SaaS) offers services to the end users those design by developer.

Examples of SaaS are Google Apps, Salesforce, Workday, Cisco WebEx.

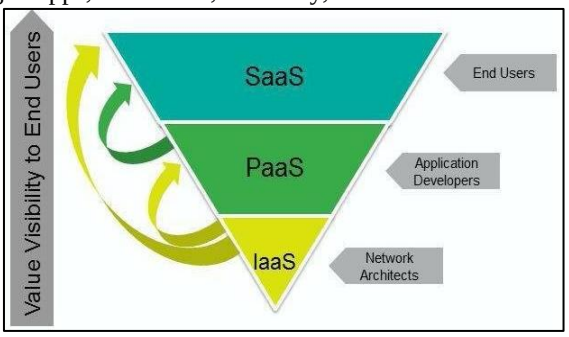

Fig. 1: SaaS

Nowadays SaaS is receiving a lots of attention from Software users and providers. Composite SaaS is one form of SaaS consist of a set of application components and data components. These components are work together for delivering the services to the higher- level functional software. In Composite SaaS data components are shared between services. Composite SaaS deliver in such a way that it allows the flexibility of SaaS functionalities in that components can be combined and recombined as per the need of users. Using this SaaS Providers can get the reduced delivery cost as well as the cost of subscription for users also decrease.

Resource Optimization is the set of processes and methods to match the available resources as per the need of organization. Resources can be in any form. It may be machinery, humans or may be financial. The Resource Optimization feature enables organization to fulfil resource requests in an optimal fashion. Resource Optimization evaluates all open resource requests against available resources and makes a staffing plan to achieve organization's objective.

Genetic Algorithm is a method for solving optimization problem using natural selection process. It is inspired by the theory of evolution in which fittest solution will survive and reproduction done until the unfit or weak solution will be discarded.

In Genetic Algorithm every individual solution is known as chromosome. The collection of chromosome is represented as a population. The main terminologies of Genetic Algorithm are as follows:

- Initial Population: It is the set of all individuals that are used in genetic algorithm to find out the optimal solution. Every solution in the population is called as an individual and every individual is represented as a chromosome for making it suitable to genetic operations. From the initial population the individuals are selected and required operations are performed on that for the next generation. The mating chromosomes are selected on some specific criteria.
- Fitness Function: A fitness function is used to measure the quality of the individuals in the population according to the given optimization objective. The fitness function can be different for different cases. In some cases the fitness function can be based on make span while in some cases it can be based on budget constraints.

- Selection: We use the proportion selection operator to determine the probability of various individuals genetic to the next generation in the population. The proportional selection operator means the probability which is selected and genetic to the next generation groups is proportional to the size of the individual's fitness.
- Crossover: We use single-point crossover operator. Single-point crossover means only one intersection was set up in the individual code, at that point part of the pair of individual chromosomes is exchanged.
- Mutation: Mutation means the values of some gene locus in the chromosome coding series was replaced by the other gene values in order to generate a new individual. Mutation is that negates the value at the mutate points with regard to binary coded individuals.
- The rest of paper structured as follows. In section II we present the analysis and related work. Section III introduces the proposed method and its steps. In section IV discussion of the work is shown. Finally Section V represents the conclusion and future work.

II. RELATED WORK

This method is used when the number of requests simultaneously. In [1], authors propose the cooperative co-evolutionary genetic algorithm (CCGA) for the Initial placement of SaaS problem and repair-based grouping genetic algorithm (RGGA) for SaaS resource optimization problem. Both the techniques produce feasible solution but computation time is quite long.

In [3] the grouping genetic algorithm (GGA) is used for optimization. This paper is mainly designed for large scale and complex combinatorial optimization problem. It solves the grouping problem. In this Genetic algorithm is dependent on the chromosome and cost function and GGA divides its chromosome based on the relevant groups. In this Optimization is done based on the cost function. In this multiple SaaS configuration is done on the dynamic cloud environment. From the result of this paper computation time of the algorithm further improve by implementing it in parallel manner.

[7] This Paper is focuses on the SaaS configuration optimization in cloud data center. SaaS application components placed on computing server and data components placed on storage server. In this optimization problem is work as an assignment problem in which different application components are deployed on different virtual machines. The fitness function calculates the total cost and migration cost.

III. PROPOSED METHOD

This Proposed work is focuses on the priority of machines. It first define the comparison matrix and based on that assign jobs to the machines.

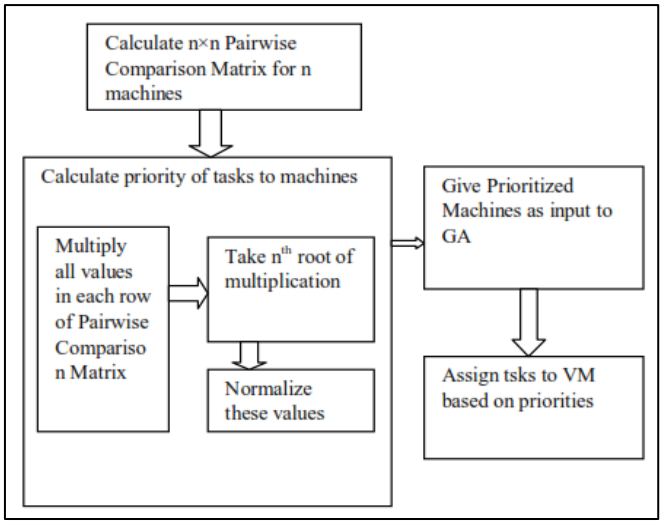

Fig. 2: Proposed work

The Proposed work is divided into six steps:

A. Step 1: [Generate priority matrix of machines using Logarithmic Least Square Method]

Step 1(a): Input n×n pairwise comparison matrix for n machines.
Step 1(b): Multiply all values in each row.
Step 1(c): Take n^{th} root of product for all rows.
Step 1(d): Normalize these values.

B. Step 2: [Calculate Load of Machines based on CPU and Memory Load]

System load (load of physical machine in cloud) = l ∗ (cpu load) + m ∗ (memory load)

Where l represents the cpu weightage and m represents memory weightage.
This weightage can be calculated using equation as below:

$$w_i = \sum v_i / h_i$$

where i=1 to d, which is the ratio between the total demand for resource i and the capacity of the host.

C. Step 3: [Genetic Algorithm]: Repeat while optimum solution is found

Step 3(a): Select two machines having highest priority in priority matrix.
Step 3(b): [Crossover]: Combine these two selected parents to form new solution which keeps same VMs from two parents and distribute different VMs from two parents to least loaded node in physical machine set until all VMs are distributed.
Step 3(c): [Mutation]: According to mutation probability, individuals are selected for mutation, From parental individuals two machines are selected and one or more VMs are swapped between these machines to form new solution.

D. Step 4: Calculate priority of tasks given to VMs.

E. Step 5: Assign tasks to VMs based on their priorities.

F. Step 6: End

IV. DISCUSSION

Our Proposed method solves the problem of computation time. This method is implemented in dynamic cloud environment, so it gives the promising results. It takes the real data at a time so it is useful in real environment. Using priority matrices method assignment of tasks easily done. The problem of overutilization and underutilization are also solved.]

V. CONCLUSION AND FUTURE WORK

Genetic Algorithm is the most Promising technique for Resource Optimization. Using this method we assign tasks based on priorities. So we provide services in terms of tasks. By giving prioritized input to Genetic Algorithm response time will be decreased and minimizes the make span of the given task set. In future, we implement proposed method in real cloud and show experiment results based on various performance parameters and compare our result with some other algorithms.

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