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Resource Scheduling in Cloud using Hybridization PGA

T. Kowsalya[1]
PG Scholar
Dept. Computer Science and Engineering
United Institute of Technology
Tamil Nadu – India

N. R. Gayathri[2]
Asst. Professor
Dept. Computer Science and Engineering
United Institute of Technology
Tamil Nadu – India

Abstract: ***Cloud Computing is ever growing technology in the internet era. It provides sharing the resources among the various users and it also provides various services to the user wherever they need. Cloud computing provides services on the Platform, Infrastructure, Software and Application as pay-as-use manner. Under the cloud environment of Infrastructure as a service the resource scheduling are not reliable because of heterogeneity and availability of environment. The genetic algorithm is a powerful technique used for resource scheduling, but Genetic Algorithms are not efficient for all the problems. A Parallel Genetic Algorithm is used for scheduling the resources in efficient manner. The proposed system uses Hybridization PGA for scheduling. HPGA uses the combinations of Master-Slave Parallelization and Coarse-Grained algorithm for resource scheduling. HPGA is an optimized scheduling algorithm for resource scheduling.***

Keywords: Cloud Computing; Infrastructure as a Service; Scheduling; Parallel Genetic Algorithm; Hybridization Parallel Genetic Algorithm;

I. INTRODUCTION

Cloud Computing (CC) is known as a provider of dynamic services using very large scalable and virtualized resources over the Internet. Cloud computing is global village based computing, whereby software and hardware resources are provided to user's on-demand. It builds virtualization super computer, with on-demand rent way which provides analysis, data storage and scientific computing services through the distributed computing model and the resource pool technology.

a. Essential characteristics of Cloud Computing

Cloud computing is different from traditional web service because of the essential characteristics behind cloud computing. These characteristics are

- On demand self services:
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service
- Multi Tenacity
- Virtualization

b. Types of cloud formation

- *Public Cloud*: Public Clouds are available to the public or a large industry group and are owned and provisioned by an organization selling Cloud services.
- *Private Cloud*: Private Clouds exist within a company's firewall and are managed by the organization. They are Cloud services created and controlled within the enterprise
- *Hybrid Cloud*: Hybrid Clouds are a combination of the public and the private Cloud is using services that are in both the public and private space.

c. *The cloud service models*

Cloud services are designed to provide scalable, easy access to applications, resources, services, and are fully managed by a cloud services provider. Cloud computing providers recommend their services according to several fundamental models. There are three types of cloud computing services.

a) Infrastructure as a Service (IaaS)

b) Platform as a Service (PaaS) and

c) Software as a Service (SaaS)

Infrastructure as a Service (IaaS)

This resource is infrastructure, which include storage, computing power and machine provisioning.

Platform as a Service (PaaS)

The development platform, environment providing services and storage is hosted in the Cloud. This type of resources in Cloud Computing is software resources including middleware and development resources.

Software as a Service (SaaS)

The distributed environment or predefined applications over the Internet are hosted as service in the Cloud. The third type of resources in Cloud Computing is applying resources.

II. BACKGROUND AND RELATED WORK

Scheduling performed using several algorithms are studied in the literature recently. Eucalyptus software proposed in [1] to solve the resource scheduling problem in the small organization. the taxonomy of the cloud computing and survey of the cloud computing discussed in [2]. Genetic algorithm with new multi-objective optimization techniques used to solve the resource scheduling in grid [3] environment. Grobner Bases theory proposed to solve integer programming and extended to solve stochastic integer programming [4]. This used to solve resource scheduling in cloud. In paper [5] coarse-grained PGA proposed scheduling resource in cloud to achieve the speed of computing. To attain maximum utilization of resources genetic algorithm [6] proposed for dynamic scheduling of data. To achieve fast and accurate PGA the following methods are used [7], simple master-slave algorithms with one population, more sophisticated algorithms with multiple populations, and a hierarchical combination of the first two cases. In paper [8] various taxonomy of parallel genetic algorithm studied.

III. INTERFACE AS A SERVICE (IAAS)

Infrastructure as a Service (IaaS) abstracts hardware (server, storage, and network infrastructure) into a pool of computing, storage, and connectivity capabilities that are delivered as services for a usage-based cost. Its goal is to provide a flexible, standard, and a virtualized operating environment that can become a foundation for PaaS and SaaS.

IaaS is usually seen to provide a standardized virtual server. The consumer takes responsibility for configuration and operations of the guest Operating System, software, and Database. The customer typically pays on a per usage basis. Infrastructure as a Service is sometimes referred to as Hardware as a Service (HaaS). For IaaS, there are some popular open-source Cloud systems, such as Eucalyptus, Open Nebula, and Nimbus.

Characteristics of IaaS include,

a) Utility computing service and billing model

b) Automation of administrative tasks

c) Dynamic scaling

d) Desktop Virtualization

e) Policy-based services

f) Internet connection

The Xdrive Box service provides online storage to users. Microsoft Sky Drive provides free storage service, with an integrated offline and online model that keeps privacy-related files on hard drives, and enables people to access those files remotely. In the area of computing power sharing, the Grid computing initiative has taken it as its major focus to use clustering and parallel computing technologies to share computing power with others, based on task scheduling when computers are idle. Typical architecture of an IaaS cloud system is depicted in figure 1.1.

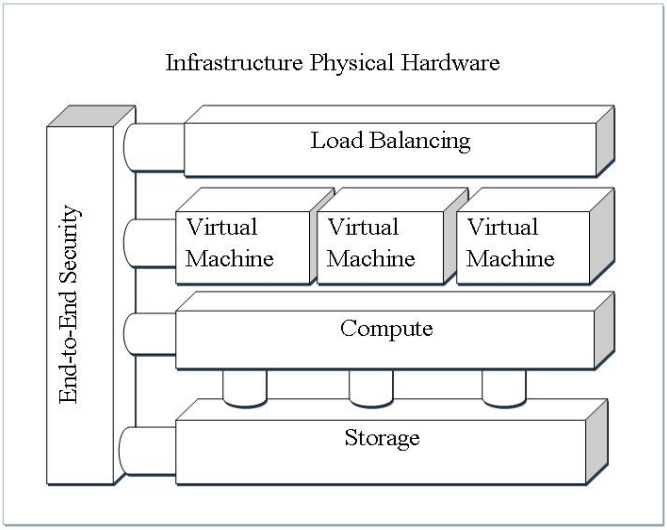

Fig 1 Typical diagram for Infrastructure as a Service Cloud Component

IV. VIRTUALIZATION TECHNOLOGY

Virtualization is a generalization of an execution environment that can be made dynamically available to authorized clients by using well-defined protocols. It is performed within a Cloud environment across a large set of servers using virtual machine monitor. One of the fundamental aspects of Virtualization technologies employed in Cloud environments is resource consolidation and management. On a cloud computing platform, dynamic resources are managed effectively using Virtualization technology. Load balancing of the entire system can be managed dynamically by using Virtualization technology where it becomes possible to remap virtual machines (VMs) and physical resources according to the change in load. Due to these compensations, Virtualization technology is being comprehensively implemented in cloud computing. However, in order to achieve the best performance, the virtual machines have to fully use its services and resources by adapting to the cloud computing environment dynamically. The load balancing and allocation of resources must be guaranteed in order to improve resource utility.

V. SCHEDULING CONCEPT

Scheduling is the process of distributing resources among the users which simultaneously and asynchronously request them. For the purpose of scheduling, the scheduling algorithms are applied. Scheduling algorithms are primarily used to reduce the starvation of resources and to ensure fairness amongst the users utilizing the resource over the net.

The objective of the scheduling is to have maximum utilization of resources and to reduce the execution time. It is the process of scheduling the activities and the resources needed by those activities while taking into consideration both the resource availability and the time involved. To make the most efficient utilization of the resources numerous scheduling techniques have been proposed.

The available scheduling strategies do not perform dynamic scheduling of the resources. The possibility to order the Virtual Machines in a flexible manner to improve the speed of finding the best allocation on the premise of permitting the maximum utilization of resources is investigated in this paper. Genetic algorithm is a powerful technique used for the resource scheduling. To achieve efficient scheduling Parallel implementation of Gas is proposed, which is faster than GA. Hybridization PGA has been proposed as the PGA model for scheduling the resources. HPGA is the combination of two Parallel Genetic Algorithms called Master Slave and Coarse Grained. HPGA combines the features of both the algorithms.

VI. GENETIC ALGORITHM

Genetic Algorithm is stochastic search algorithms based on principles of natural selection and recombination. They try to get the best possible solution to the problem at hand by manipulating a population of candidate solutions. The population is evaluated and the best solutions are selected to reproduce and mate to form the next generation. Over a number of generations, good qualities dominate the population, resulting in best quality of the results.

Basic Steps in Genetic Algorithm

1. Get the initial population of individual
2. Find the fitness value for every individual
3. Select the individual for further recombination of individual
4. Mutate the individual
5. Evaluate the fitness value for modified individual
6. Terminate the process when the algorithm met the criteria.

PARALLEL GENETIC ALGORITHMS

Parallel Genetic Algorithm (PGA) is parallel implementations of GAs which can provide considerable gains in terms of performance and scalability. PGA can easily be implemented on networks of heterogeneous computers or on parallel mainframes.

a. Master-Slave Parallelization

Since this type of parallel GA, selection and crossover consider the entire population it is also known as global parallel GAs. Master-slave Model (MSM) is mainly a variation to increase speed, scale and calculation power for GA. Distribution of crossover and mutation operations, and in some cases fitness calculation, can be done to different processors. This allows utilization of the computing power of several processors or distributed computer systems to solve the problem.

With the use of the additional resources from distributed computing, system is not dependent on the development of hardware for single systems, to be able to compute more complex problems. On single systems such problems might not be

possible to solve within a reasonable time.MSM assigns a fraction of the population to the available processors for evolutionary operation. It seems that it can work in two ways. The first one is synchronous, which only has the benefit of faster computing. Once the population is assigned to the processors, synchronous MSM waits for all the processors to make out their operations and deliver the result before evaluating the new population. The second one is asynchronous, which does not wait for slow processors to return their result. These work a bit different than standard GA. Figure 3.2 shows the typical function of master-slave parallel genetic algorithm.

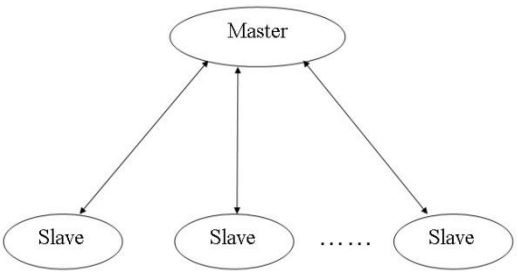

Fig 2 Schematic diagram of Master-Slave PGA

b. Coarse-Grained Parallel Genetic Algorithm

Coarse grained algorithms are a general term for a subpopulation model with a relatively small number of demes with many individuals. These models are characterized by the relatively long time they require for processing a generation within each deme, and by their occasional communication for exchanging individuals. Sometimes coarse grained parallel GAS is known as distributed GAS because they are commonly implemented on distributed memory MIMD computers. This approach is also well suited for heterogeneous networks. Figure 3.2 shows the schematic of Coarse-Grained PGA.

In Coarse-Grained PGA, the population is divided into computing nodes which have a sub-population and executes genetic algorithm on its own. The nodes will exchange chromosomes with each other ensuring that good results can be spread to other nodes. This exchange can be called as migration where a node sends its best chromosome to other nodes. The other nodes which are having the worst chromosome will be replaced by the received one. One of the computing nodes will be assigned a special task to accumulate results from all the other nodes and then choose the best result as the end product of parallel genetic algorithms. This node called as collector node.

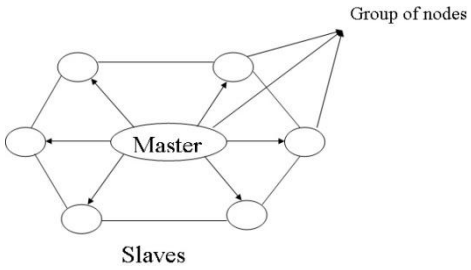

Fig 3 Schematic diagram of Coarse-Grained PGA

c. Hybridization Parallel Genetic Algorithm

The proposed system uses the Hybridization of Parallel Genetic Algorithm for resource scheduling algorithm in the cloud. Hybridization model combines the features of master slave and coarse grained algorithm of the PGA. It provides the efficient way of resource scheduling in a cloud environment. It operates as a coarse-grained in higher level and as a master-slave in lower level. The figure 3.1 shows the function of hybridization of parallel genetic algorithms.

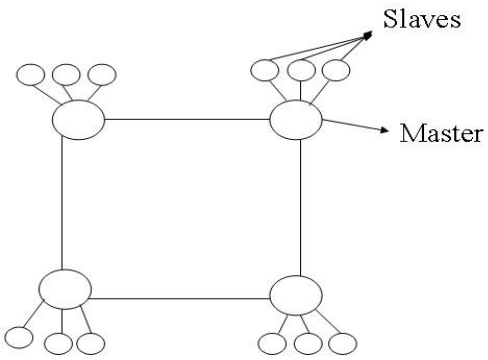

Fig 4 Schematic diagram of Hybridization PGA

VII. CONCLUSION

In cloud computing environment resource management and scheduling is the key issue related to process efficiency of computing task and service quality. The scheduling problem is considered as an unbalanced assignment problem. A parallel process of genetic algorithm approach is introduced for reducing the processing time and improving search performance. Comparing to genetic algorithm, the hybridization parallel genetic algorithm gives the effective use of an increasing the resource utilization in the cloud environment. It provides speed of finding best allocation in cloud. This HPGA uses the global selection and migration operation among the population in IaaS cloud. This provides the best suitable fitness value for the resource scheduling in cloud. Future work will include a more complete characterization of the constraints for scheduling in a cloud computing environment, improvements for the convergence with more complex problems.

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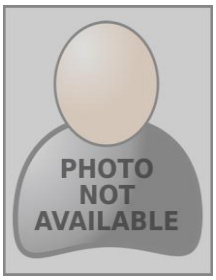
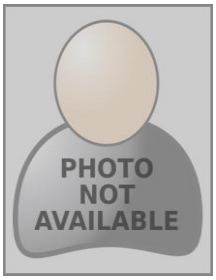
AUTHOR(S) PROFILE



T.KOWSALYA received B.E. degree in Computer Science and Engineering from KGiSL Institute of Technology, Annan University in 2012. Presently she is pursuing her Master of Engineering in Computer Science and Engineering at United Institute of Technology, Tamil Nadu, and India.



N.R. GAYATHRI received M.E. degree in Computer Science and Engineering from Bannari Amman Institute of Technology. Presently she is working as Assistant Professor in United Institute of Technology, Tamil Nadu, and India.

