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Cloud Based Virtual Machine Allocation Techniques: A Survey

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Abstract-- Cloud computing is an ocean of resources which are shared among multiple users for processing over the internet by cloud services like software, infrastructure and platform oriented. Based on the user requests, various processes such as allocation, computation, execution are performed in the cloud environment. An allocation is the most challenging process in the cloud environment. Virtualization technology is the main technology provided by the cloud that is used for that processes. Virtual machines are used for allocating the resources according to the user request. Many algorithms and techniques are used for virtual machine allocation in the cloud environment. In this paper we provide an overview of the fundamental theories and emerging techniques for cloud based virtual machine allocation process as well as several extended work in these areas. This writing provides a research on the cloud based virtual machine allocation techniques that are frequently used in the early work in cloud environment.

Keywords: cloud computing, resource sharing, virtual machine allocation, virtualization, cloud environment.

I. INTRODUCTION

Cloud computing is growing value day-by-day. The large number enterprises or organizations and individual persons are shifting and selecting for cloud computing services. Thousands of servers have been worked worldwide to provide the needs of customers for computing services by huge organizations like Amazon, Microsoft, IBM and Google. Clouds are classified into four models: public, community, private and hybrid.

In Public cloud, the cloud service providers are maintained and managed the applications. They are charges the usages of consumers. Private cloud model is designed for single organization. Other organizations are not allowed to processed and shared. It has maximum security and privacy. Community cloud model is shared into various organizations. Cloud service is providing a third party to manage the cloud and it is available on or off premises. Hybrid cloud model designed for an organization of both private and public cloud. They have different types of cloud so it is allowed the data to be transferred from one cloud to other cloud. [1]

There are three service offerings of cloud computing: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). IaaS providers are used to deliver on-demand elements for building an infrastructure such as storage, bandwidth, and commonly virtual servers that can be personalized with the required software stack for utilizing applications. PaaS providers delivered development and runtime environments for applications, which are stored on the Cloud. It allows providing a scalable middleware for the management of application execution and dynamic resource provisioning. SaaS providers are used offering applications and services on-demand that are accessible through the Web. SaaS applications have the features of multi-tenant and it is collected by the integration of different components available over the Internet. [2]

The rest of this paper is organized as follows. Introduction of cloud computing environment is discussed in section I. Literature review is discussed in section II. In section III, we present a conclusion of this paper.

II. LITERATURE REVIEW

In this section provides different approaches which works towards virtual machine allocation surveyed earlier. This survey defines how the different algorithms worked well on virtual machine allocation process in the cloud environment.

Absalom E. Ezugwu et.al [2013] has presented a Virtual Computing Laboratory framework model is used in the private cloud by extending the open source IaaS solution Eucalyptus. A rule based mapping algorithm is used for formulated Virtual Machines (VMs) based on the principles

of set theoretic is also presented. The design of algorithm is projected to automatically adapt the mapping between VMs and physical hosts' resources. The paper has presented a theoretical study and derivations of some performance evaluation metrics based on the choice of mapping policies, these includes defining the context switching, waiting time and response time for the proposed mapping algorithm. Hence, this approach will lead to an efficient utilization of resources available to facilitate maximum computing with minimum physical data centers infrastructures. [3]

AwadaUchechukwu et.al [2014] has delivered formulations and solutions for Green Cloud Environments (GCE) to minimize its environmental impact and energy consumption under new models by using static and dynamic portions of cloud components. The proposed methodology captured cloud computing data centers and presented a generic model for them. The author investigate energy consumption patterns for implementation of this paper and show that by applying suitable optimization policies directed through the energy consumption models, it is possible to save twenty percent the energy consumption in cloud. This paper has presented energy consumption formulas for calculating the total energy consumption in Cloud environments and show that there are incentives to save energy. It described an energy consumption tools and empirical analysis approaches. Additionally, this work provided generic energy consumption models for server idle and server active states. This paper result is crucial for developing potential energy legislation and management techniques to minimize energy consumption though system performance is achieved for Cloud environments. [4]

Bramantyo Adrian et.al [2015] used a framework cloud simulator CloudSim version 3.0 and K-means clustering algorithm is used for virtual machine allocation method. These methods using K-means clustering algorithm compared with existing FIFO algorithm on CloudSim. These comparison test have two scenarios, first one is each datacenter has only one host and the second, each datacenter has two hosts and both have same amount of work. This work get the analysis result obtained from both scenarios is K-means is better than FIFO in virtual machine CPU utilization by reducing idle time and performing load balancing virtual machine in each datacenter. These result of this research in order to increase virtual machine CPU utilization. Using cloudlet scheduler algorithm K-means allocation method can increase execution time and level of CPU utilization by allocating cluster, which contains high-end performance virtual machine on the first datacenter and low-end performance virtual machine on the last datacenter. K-means algorithm can do load balancing in host resource in datacenter and virtual machine CPU utilization can increase during simulation. [5]

Hemlata S. Urade et.al [2011] has presented a review on PSO in single and multi-objective optimization. The author presented the basic PSO algorithm and various techniques used in pre-existing algorithms. It also described the simulation result which is carried out on benchmark functions of single objective optimization with the help of basic PSO. The author explained the basic steps of PSO which has been used in proposed approach. Result shows that simple PSO performs well in 2 dimensions as compared to 10 dimensions. [6]

Inderjit Singh Dhanoaet.al [2015] has proposed a genetic algorithm to optimize various parameters i.e. power consumption, response time, SLA violation and VM migrations. The proposed hybrid algorithm supplies various VMs to hosts in a way that to minimize power consumption, while delivering approved Quality of Service. Results of proposed HVMA algorithm helps to minimize power consumption and to optimize various performance parameters during live migrations in various environments. A new fitness function of the genetic algorithm in HVMA Algorithm has been applied and the performance compared with the defined base algorithm. The results of the HVMA algorithm are to be good enough in comparison to the base algorithm in terms of performance and efficiency. On average the solutions produced by the HVMA algorithm are 66% better than those produced by the Base Algorithm. [7]

M.FatihTaşgetiren et.al [2002] has presented a binary particle swarm optimization algorithm for the lot sizing problem. This work would find order quantities which will minimize the total ordering and holding costs of ordering decisions. Testing problems has constructed randomly, and solved optimally by Wagner and Whitin Algorithm. The author written a code for binary particle swarm optimization algorithm and a traditional genetic algorithm and solve the test problems in order to compare them with those of optimal solutions by the Wagner and Whitin algorithm. It shows the Experimental results that the binary particle swarm optimization algorithm is capable of finding optimal results in almost all cases. The objective is to present the potential power of the binary PSO to solve the binary/discrete optimization problems, which has a variety of applications in the real world. This paper results are promising to apply the binary PSO to the combinatorial optimization problems formulated as (0, 1) integer programming. The advantages of the PSO are very few parameters to deal with and the huge number of processing elements, so called dimensions, which make possible to fly around the solution space effectively. This algorithm meets to a solution very quickly which dealth should be carefully with when using it for combinatorial optimization problems. [8]

Mohammed Joda Usman et.al [2017] has proposed Energy-Efficient Virtual Machine allocation technique using

Interior Search Algorithm (ISA) that reduced the datacenter energy consumption and resource underutilization. The results showed that, the energy consumption of GA and BFD is 90% - 95% as compare to the proposed EE-IS which around 65%. On average 30% of energy has been saved using EE-IS as well the utilization of the resources which has also improved**.** [9]

Parikh Aneri et.al [2017] has proposed the load balancing policy using Hungarian algorithm. This Algorithm provided dynamic load balancing policy with a monitor component. These Monitor component helps to increase cloud resource utilization by managing the Hungarian algorithm by monitoring and changing its state based on artificial intelligent. The proposed work used CloudSim that is an extensible toolkit and it simulates cloud computing environment. It provides simulation and modeling in cloud computing. It maintained a fair distribution flow between Virtual machines and Cloudlets by Hungarian algorithm. That's why it increases the throughput of computing environment. Monitoring component helped to current resource utilization and assign pending task to other virtual machine such that all task can be completed with least number of the virtual machines. Thus, the result increases the cloud resource utilization. [10]

Solmaz Abdi et.al [2014] discussed three heuristic approaches for task scheduling on cloud environment and it has been compared with each other. These are PSO algorithm, genetic algorithm and modified PSO algorithm for efficient task scheduling. The goal of these three algorithms is to make an optimal schedule in order to minimize completion time of task execution. From this paper task scheduling problem in cloud computing environment is evaluated. Already known PSO algorithm and Genetic algorithm are most famous algorithms for scheduling tasks in distributed systems. The performance of standard PSO algorithm is improved by the modified PSO algorithm is suggested. The experiments shows PSO algorithm better results than Genetic algorithm. But modified PSO algorithm performs well of these two algorithms from minimizing make span point of view. This algorithm has applied for efficient scheduling of tasks on existing resources, so that completion time of tasks becomes reduced. [11]

Voratas Kachitvichyanukul et.al [2012] first gave a detailed introduction to the three EA techniques to highlight the general computational procedures. The common observations on the similarities and differences among the three algorithms based on computational steps are discussed, contrasting the basic performances of algorithms. This paper show the summary of relevant literatures is given on job shop, flexible job shop, vehicle routing, location-allocation, and multimode resource constrained project scheduling problems. [12]

The survey of this paper is to summarize the existing methods of virtual machine allocation in cloud based environment and its advantages, and also describe the evaluation metrics to be used previously. This will be shown in Table 1.

Table 1: Various Techniques for Cloud Computing based Virtual Machine Allocation Process

Authors	Proposed Methods	Evaluation Metrics	Advantages
Absalom E. Ezugwu, Seyed M. Buhari, Sahalu B. Junaidu [2013]	Rule based mapping algorithm based on set theoretic concept	Context switching, Waiting time, Turnaround time, Response time	Automatically adapt the mapping between VMs and physical hosts' resources
Awada Uchechukwu, Keqiu Li, Yanming Shen [2014]	Energy consumption formula for calculating energy consumption	Power saving models 1.Modeling server idle state, 2. Modeling cooling systems, 3. Modeling power conditioning systems, 4. Modeling dynamic server state	Minimize its environmental impact and energy consumption
Bramantyo Adrian [2015]	K-means clustering algorithm	Comparison of Virtual machine utilization, Comparison of idle time	Increase CPU utilization by reducing idle time and Performing load balancing VM in each datacenter
Hemlata S. Urade [2011]	PSO algorithm	Mean of global best	To understand the detailed explanation of basic steps of PSO
Inderjit Singh Dhanoa [2015]	HVMA algorithm	VM migrations, SLA violation, Power consumption, Response time	Minimize power consumption
M. Fatih Taşgetiren & Yun-Chia Liang [2002	Binary PSO algorithm	Minimum, Maximum, Average, Standard deviation	Finding optimal results in almost all cases.
Mohammed Joda Usman, Abdul Samad, Ismail, Hassan Chizari and Ahmed Aliyu [2017]	Interior Search Algorithm	Experimental parameter setting. Energy consumption of EE-IS, GA and BFD for VM Allocation	Reduces the datacenter energy consumption and resource underutilization. Utilization of the resources improved

Parikh Aneri, Sumathy S [2016	Hungarian Algorithm	Virtual machine allocation policy	Increases the throughput and the cloud resource utilization
Solmaz Abdi, Seyyed Ahmad Motamedi, and Saeed Sharifian [2014]	Modified PSO Algorithm	Number of Tasks, Number of resources, Make span, Improvement performance	Minimize completion time of task execution
Voratas Kachit vichyanukul [2012]	GA,PSO,DE algorithm	1. Qualitative comparison of GA, PSO, DE. 2. List of relevant literatures	Job shop, flexible job shop, vehicle routing, location-allocation, and multimode resource constrained project scheduling problems.

III. CONCLUSION

Cloud computing is a vital role in modern researches. Now a day's cloud environments are mostly used in many organizations because of features of cloud such as security, scalability, elasticity, storage space and more. The most important feature is virtualization. Modern techniques, virtual machines are used instead of servers. It will lead to an efficient utilization of resources available to facilitate maximum computing with minimum physical datacenters infrastructures. This paper investigates the techniques and provides comparison analysis table it shows the proposed methods, performance evaluation and to analyze the algorithms and motivates to find more evaluation metrics. Thus the modern techniques involved cloud based virtual machine allocation that is frequently used. It concludes that completion time of tasks becomes reduced. The main thing is finding optimal results, reduces energy consumption and resource utilization, minimum completion task.

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