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Review

Empirical Study Of Virtual Machine Placement Algorithm

Akram S. Alhammadi*, ,Sulaiman Ghaleb, Salem Ba hamaid, Dr.V.Vasanthi

Computer Science Department, Rathinam College of Arts and Science, Bharathiar University, Coimbatore, India.

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Abstract

Virtual machine placement is one of the most important features in virtual machine technology. It plays a crucial role in resource utilization, load balancing, and in reducing energy consumption. This paper represents the survey of various types of virtual machine placement techniques and algorithms in cloud computing.

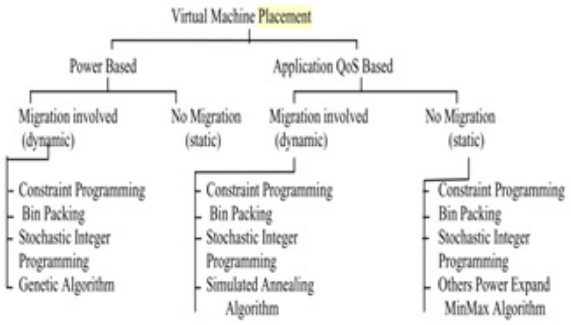
* Corresponding author: Akram S.A. Alhammadi
E-mail: Akram_aqlan@hotmail.com

1. Introduction

Cloud computing is a technique of supplying technology means like servers, storage, databases, networking, software, and platform to the end user through Internet. It performs the main role in today's information technology. All services are provided via internet, and are established through a pay-as-you-use, and on-demand resources. It offers three levels of services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Virtualization allows better performance of a server by creating many virtual machines in the cloud that store different and multiple operating systems on a single shared computer. It can be used over the network by operating web browser and fast network connection.[1] Virtual Machine is an operating system environment that is installed in a software, and which imitates dedicated hardware. Large computers or servers may run various VMs, providing different services. [2] Live virtual machine (VM) migration refers to the process of moving a running virtual machine or application between different physical machines without disconnecting the client or the application itself. It demands moving all the state information of the VM that are being migrated, with memory state, network state and storage state, from one physical server to another within the same data center or across remote data centers [3]. Physical machines (PMs) in data centers may have to periodically undergo maintenance processes; we may enable the migration of VMs to other active PMs, utilize the usage of resource or consume power usage. With the increasing size of storage requirements, the inefficient use of resources causes high energy consumption [4, 5]. The rest of this paper is organized as follows: section 2 discusses virtual machine placement algorithms, and section 3 presents the conclusions.

2.Virtual Machine Placement Algorithms

Virtual Machine (VM) placement is a very important process that is conducted as part of the VM migration and aims to find the best Physical Machine (PM) to host the VMs. Many VM placement algorithms are offered for VM placement in the cloud computing; that used to improve various factors affecting the virtual machine, host, and datacenter. There are two commonly used policies; static allocation and dynamic allocation. Static allocation manually assigns VM to servers. Resource allocation limits consolidation and increases the cost of running the services [6]. The dynamic allocation of VMs with live migration has received significant attention in comparison to the proposed algorithms that have been provided. The VMs are firstly assigned to servers according to a normal workload, then, the migration procedure is performed when servers are overloaded or underutilized. Static resource allocation is different from the dynamic resource allocation method; it does not need planning. In dynamic allocation the number of active servers is adjusted dynamically. There are many algorithms that have been offered to handle the VM placement problem. Based on a placement goal, Anjana Shankar [7] broadly classified VM Placement algorithms in her research as follows:



Unified ant colony system (UACS)[8] at the beginning, it has a plenty of servers to host the VM. Then, it reduces the number of host and minimizes VM migrations. It is compared to ACS algorithms.

Best-fit Decreasing Heuristic Algorithm [9] is proposed to use the fullest capacity of the first host before using the other one. It is compared to both the shortest job first allocation and the round-robin allocation.

Genetic Ant Colony Algorithm (GACA- VMP) [10] is efficiently minimizing the used resourc-

es, like the number of servers. It contrasts with the Ant Colony Algorithm that minimizes the resource wastage and power consumption. It is also compared to the Multi-Objective Evolutionary Algorithms.

Modified Best Fit Decreasing (MBFD) [12] is proposed to find the best place for VM; that minimizes the power consumption like VMPMBBO. It differs from Best Fit Decreasing (BFD).

Dynamic VM Consolidation Algorithm [13] is proposed to reduce both energy consumption and SLA violations.

Minimization of migrations Algorithm [12] is proposed to select the minimum number of VMs needed to migrate from a host to lower the CPU utilization below the upper utilization threshold; by selecting the VM with the highest utilization. Load Aware Virtual Machine Placement (LAVMP) Algorithm [14] is planned to load data centers in order to minimize network costs and energy consumption. It needs a fewer migration number of VM. It is compared to energy aware placement methods, which requires nearly the same energy.

Dynamic VM placement [15] achieved a high resource utilization rate (minimal number of host) and minimized power consumption. Improved Grouping Genetic Algorithm (IGGA) [16] used to decrease the number of VM migration and minimize the power consumption like UACS .It is compared with MBFD.

Multi-objective ant colony system algorithm (MOACS) [17] is planned to reduce the number of hosts, and try to minimize the number of the VM migration, in similarity to IGGA and UACS; which are compared to the Ant Colony Optimization and the Ant Colony System.

Load Level based Optimization for Virtual Machine Allocation (LLOOVIA) [18] is used to find the optimal location for the VM based on the service.

Multi-Objective Ant Colony System Algorithm [19] minimizes the resource wastage and power consumption. It is similar to Dynamic VM placement. It generally outperforms multi-objective genetic algorithm, two single-objective algorithms, a well-known bin- packing algorithm and a max–min ant system (MMAS) algorithm.

There are a lot of elements that are considered when we place a virtual machine on a host such as:

1) Decrease the migration process as much as possible; as it can save resource consumption such as network bandwidth.

2) There are rules to determine when to migrate VMs under some conditions; such as energy saving or heavy load on some host. And we need to make the urgent decision.

3) Decision must be taken to select which VMs are to be migrated.

4) Exploring a group of host to identify the place where possibly VM can be stored

5) Policies for determining when to turn off/on hosts to save power

Here is the summary table for the various algorithms that are used in virtual machine placement and their aim in a tabular form.

No.	Algorithm	Energy Consumption	Resource Utilization	Fewest VM Migrations
1	Unified Ant Colony System (UACS)		yes	yes
2	Best-Fit Decreasing Heuristic Algorithm		yes	
3	Genetic Ant Colony Algorithm (GACA-VMP)			
4	Multi-Objective Biogeography-Based Optimization VMPMBBO	yes	yes	
5	Modified Best Fit Decreasing (MBFD)	yes		
6	Dynamic VM Consolidation Algorithm	yes		
7	Minimization of Migrations Algorithm		yes	

8	Load Aware Virtual Machine Placement (LAVMP) algorithm	yes		yes
9	Dynamic VM placement	yes	yes	
10	Improved Grouping Genetic algorithm(IGGA)	yes		yes
11	Multi-Objective Ant colony System Algorithm(MOACS)	yes		yes
12	Load Level based Optimization for Virtual machine Allocation(LLOOVIA)			yes
13	Multi-Objective Ant Colony System Algorithm	yes	yes	

3. Conclusion

Virtual machine (VM) placement is the procedure of selecting the most suitable server in a datacenter that will hold newly created VMs, or will host a migrated VM. This paper presents the virtual machine placement algorithms; which are used to minimize the power consumption or the efficiency of resources' use. There is no clear indication, but we can say that the 'Best-Fit Decreasing Heuristic Algorithm' is the best; in case of using the resource more efficiently.

In the future, we are going to implement an algorithm that chooses VM for migration and a set of host selection heuristic algorithm for defining where to migrate virtual machine; based on constraints that will improve the overall performance of migration and using the resources efficiently.

References

1.Abdelsamea, Amany El-Moursy, Ali A. Hemayed, Elsayed E. Eldeeb, Hesham , (2016), "Virtual Machine Consolidation Enhancement Using Hybrid Regression Algorithms" ,Egyptian Informatics Journal, Production and hosting by Elsevier.

2.Sun, Gang Liao, Dan Anand, Vishal Zhao, Dongcheng Yu, Hongfang Yu, (2016), "A New Technique For Efficient Live Migration Of Multiple Virtual Machines", Future Generation Computer Systems , Production and hosting by Elsevier.

3.Martin Duggan ,Jim Duggan , Enda Howley , Enda Barrett, (2017) ,"A Network Aware Approach For The Scheduling Of Virtual Machine Migration During Peak Loads", Springer Science+Business Media New York .

4.Beloglazov, A.; Buyya, R. ,(2012), "Optimal Online deterministic algorithms and adaptive heuristics for energy and performance efficient dynamic consolidation of virtual machines in cloud data centers", Concurrency Computation Practice and Experience.

5.Callou, G.; Ferreira, J.; Maciel, P.; Tutsch, D.; Souza, R.,(2014)," An integrated modeling approach to evaluate and optimize data center sustainability, dependability and cost", Energies 2014, 7, 238–277.

6.Verma,M.; Gangadharan, G.R.;Narendra,N.C.; Vadlamani, R.; Inamdar, V.; Ramachandran, L.; Calheiros, R.N.; Buyya,R. ,(2016) ,"Dynamic resource demand prediction and allocation in multi-tenant service clouds". Concurr. Computat. Pract. Exp.

7.Anjana Shankar,(2010), "dissertation on Virtual Machine Placement in Computing Clouds".

8.Liu, Xiao-Fang;Zhan, Zhi-Hui;Deng, Jeremiah D.;Li, Yun;Gu, Tianlong;Zhang,Jun, (2016)," An Energy Efficient Ant Colony System for Virtual Machine Placement in Cloud Computing", IEEE Transactions on Evolutionary Computation.

9.Chowdhury, Mohammed Rashid;Mahmud, Mohammad Raihan;Rahman, Rashedur M,(2015), "Implementation and performance analysis of various VM placement strategies in CloudSim", Journal of Cloud Computing

10.Hong, Liang ;Yufei, Ge,(2015), "GACA-VMP: Virtual Machine Placement Scheduling in Cloud Computing Based on Genetic Ant Colony Algorithm Approach" , 2015 IEEE 12th Intl Conf on Ubiquitous Intelligence and Computing and 2015

IEEE 12th Intl Conf on Autonomic and Trusted Computing and 2015 IEEE 15th Intl Conf on Scalable Computing and Communications and Its Associated Workshops (UIC-ATC-ScalCom).
11.Zheng, Qinghua;Li, Rui;Li, Xiuqi;Shah, Nazaraf;Zhang, Jianke;Tian, Feng;Chao, Kuo Ming;Li, Jia ,(2016),"Virtual machine consolidated placement based on multi-objective biogeography-based optimization" , Future Generation Computer Systems
12.Beloglazov, J. Abawajy, and R. Buyya,(2012), “Energy-aware resource allocation heuristics for efficient management of data centers for cloud computing,” Future Generation Computer Systems.
13.Huang, Jing;Wu, Kai;Moh, Melody,(2014), "Dynamic Virtual Machine Migration Algorithms Using Enhanced Energy Consumption Model for Green Cloud Data Centers" , IEEE
14.Chengjiang Liu(2016), "A Load Balancing Aware Virtual Machine Live Migration Algorithm", 4th International Conference on Sensors, Measurement and Intelligent Materials (ICSMIM 2015).
15.Mallu, Lalithabhinaya;Ezhilarasie, R.,(2015)," Live migration of virtual machines in cloud environment: A survey", Indian Journal of Science