



An Approach For Generating A Related Algorithm With An Aim For Virtual Machine Placement In Cloud For Enhancing Packaging Efficiency And Reducing Physical Servers In Data Centers With Features Of Security

¹Nitesh Kaushik, ²Dr. Chinmay Bhatt

¹Department of Computer Science and Engineering, RKDF-IST, SRK University, Bhopal, M.P, India

² Department of Computer Science and Engineering, RKDF-IST, SRK University, Bhopal, M.P, India

Abstract: With the exponential growth of cloud computing, efficient utilization of physical resources has become a critical concern for data center operators. One of the main challenges is the best placement of virtual machines (VMs) to increase packaging efficiency and reduce the number of active physical servers, to reduce energy use and operational costs. This paper proposes a novel algorithmic approach for VM placement that not only focuses on enhancing resource utilization and packaging efficiency but also integrates security-aware features into the placement process. By leveraging a hybrid optimization technique that combines heuristic and machine learning strategies, the proposed solution dynamically evaluates VM requirements and server capacities in real-time. Furthermore, the algorithm incorporates security constraints to prevent co-residency attacks and ensure tenant isolation. Experimental evaluations on simulated cloud environments demonstrate significant improvements in resource consolidation, reduction in the number of active physical servers, and enhanced security compliance compared to traditional VM placement strategies. This approach offers a scalable and secure solution for next-generation cloud data centers.

Index Terms - Virtual Machine Placement, Cloud Computing, Resource Optimization, Packaging Efficiency, Data Center Consolidation, Security-Aware Placement, Co-residency Prevention, Energy Efficiency, Hybrid Optimization, Server Utilization.

I. INTRODUCTION

Computing is an archetypal comprising of services that are commoditized and elated in a manner similar to old-style efficacies such as water, electricity, gas, and telephony. In this type of model, users access services built on their requirements without regard to where the concern services are hosted or in which way they are delivered. Various computing paradigms have guaranteed to carry this utility computing vision and consist of cluster computing, Grid computing, and more recently Cloud computing. Grid computing, and more recently Cloud computing. The end term denotes the infrastructure as a Cloud from which businesses and users are able to entree applications from anywhere in the world on demand. So, the related computing world is rapidly converting towards developing software for millions to consume as a service, rather than to run on their discrete computers. At present, it is common to entree content across the Internet independently without location to the underlying hosting infrastructure. This concern infrastructure comprises of data centers that are monitored and maintained around the clock by content providers. Cloud computing is a leeway of this paradigm wherein the capabilities of business applications are unprotected as sophisticated services that can be retrieved over a network. In addition, enterprise service consumers with global operations need faster response time, and thus save time by distributing workload desires to multiple Clouds

in various locations at the same time. This makes the need for establishing a computing atmosphere for vigorously interconnecting and provisioning clouds from multiple domains in and across enterprises. There are various challenges involved in creating such clouds and cloud interconnections.

Cloud providers like Amazon, Google, Salesforce, IBM, Microsoft, and Sun Microsystems have begun to generate new data centers for hosting Cloud computing applications in different locations across the world to provide redundancy and confirm reliability in case of site failures. Since user requirements for cloud services are diverse, service providers have to ensure that they can be lithe in their service delivery while keeping the users isolated from the fundamental infrastructure. Latest advances in microprocess or technology and software have led to the growing ability of commodity hardware to run applications within Virtual Machines (VMs) efficiently. VMs allow both the separation of applications from the underlying hardware and other VMs, and the customization of the platform to outfit the needs of the end user.[1]

While convenient, with the use of VMs gives rise to further trials such as the intelligent allocation of physical resources for handling competing resource demands of the users. In addition, enterprise service consumers with global operations need faster response time, and thus save time by distributing workload desires to multiple Clouds in various locations at the same time. This makes the need for establishing a computing atmosphere for vigorously interconnecting and provisioning Clouds from multiple domains in and across enterprises. There are various challenges involved in creating such Clouds and Cloud interconnections. So, in this paper the recent trends in the planetary of Cloud computing and shows candidates for future improvements of this technology. [1]

II. LITERATURE SURVEY

The main aim behind cloud computing is not a new one. John McCarthy in 1960s already intended that computing facilities will be given to the general public like an efficacy [39]. The term “cloud” has also been used in various contexts such as telling large ATM networks in the 1990s. However, it was after Google’s CEO Eric Schmidt used the word to define the business model of providing services across the Internet in 2006, that the term really ongoing to gain popularity. Since then, the term cloud computing has been used mostly as a marketing term in a variety of contexts to represent many different ideas. For this reason, recently there has been work on regulating the definition of cloud computing. As an example, the work in [49] compared over 20 various definitions from a variety of sources to confirm a standard definition. In this paper, we accept the definition of cloud computing given by The National Institute of Standards and Technology (NIST) [36], as it shelters, in our opinion, all the dynamic aspects of cloud.

According to NIST Cloud computing is a model which allows comfortable, on-demand network entree to a shared pool of configurable computing incomes with tiniest management effort

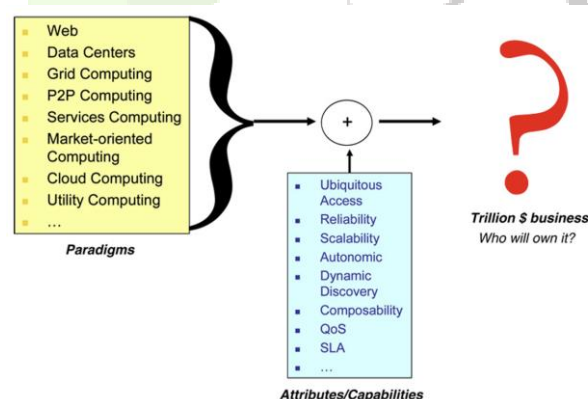


Fig. 1 Various Standards capable to distribute IT as a service

This internet use of standalone computers reveals the promising potential of utilizing seemingly endless amount of distributed computing capitals owned by various owners. In coming years, new computing models (shown in Fig. 1) have been projected and adopted to edge closer toward achieving a vision [1]. The aim of P2P computing includes cost sharing or decrease, resource aggregation and interoperability, better scalability and reliability, increased autonomy, anonymity or privacy, dynamism, and ad-hoc communication and association [2].

III. PROBLEM FORMULATION

The cloud environment encompasses a large number of server nodes, and it is expected that the data center infrastructure is completely virtualized and all the concern applications are presently running on virtual machines. Conveying a VM (Virtual Machine) to a PM (Physical Machine) can be measured a multi-dimensional vector packing problem, and the size of the container is supplying capacity of the physical machine. This work reflects virtual machines and server nodes to be features of two-dimensional resources (CPU and memory). This research is not considering disk storage as network attached storage (NAS) is presumed to be used as the primary storage in the cluster. If a server node is introducing n virtual machines, the CPU use of that related server is to be the sum of the CPU use of the related virtual machines. This particular concept is being applied to memory resources. Consider an example, in which a server node is hosting two virtual machines. The first VM needs 14%, 250% of the server's CPU and server's memory, and the second VM needs 25%, 45%. so, the server utilization is projected to be 30%, 75%. So, in other words, every server hosts many virtual machines (VMs) and delivers appropriate resources (such as CPU, RAM) for every machine to be able to run all processes.

$$U_j^{cpu} = \sum_{i=1}^m x_{ij}^{cpu} \quad (\text{Eq. 1})$$

$$U_j^{mem} = \sum_{i=1}^m x_{ij} v_i^{mem} \quad (\text{Eq. 2})$$

Where U_j^{cpu} and U_j^{mem} are correspondingly the cpu utilization and memory utilization of server j , m is the number of active servers.[3]

In this concern section shows VM placement as a new objective combinatorial optimization problem that shows to optimize both energy consumption and the complete resource wastage. New objective evolutionary optimization algorithms are using population-based method to trace a feasible solution.

IV. PROPOSED METHODOLOGY AND VM PLACEMENT PROBLEM SOLUTION

MBO is based on new population meta-heuristic algorithm, announced by wang et al. It deals and shortens the migratory behavior of monarch butterflies among the two different places when the season change. MBO is consuming the migration operator and the adjusting operator to evaluate the recently generated butterflies. The related concept can be given with the terms like starting, fitness assessment, separation, movement and change.

Algorithm 1 Movement operator

1. start
2. for $i = 1$ to $\text{size}(\text{Pop } 1)$
3. do
4. for $k = 1$ to Dim (all the related element in i th Butterfly)
5. do
6. $r_1 = \text{rand} * \text{period}$
7. if $r_1 \leq p$ then
8. $r_2 = \text{round}(\text{size}(\text{Pop } 1) * \text{rand} + 0.5)$
9. $\text{Pop } 1(i, k) = \text{Pop } 1(r_2, k)$
10. else
11. $r_2 = \text{round}(\text{size}(\text{Pop } 1) * \text{rand} + 0.5)$
12. $\text{Pop } 1(i, k) = \text{Pop } 2(r_2, k)$
13. end the if
14. end for the k
15. end for the i
16. end

Thus, the concern algorithm scores on the controller node to reduce the power use and the price of cooling process. This concern algorithm rounds on the controller node to lessening the use of power and cooling process cost [4]

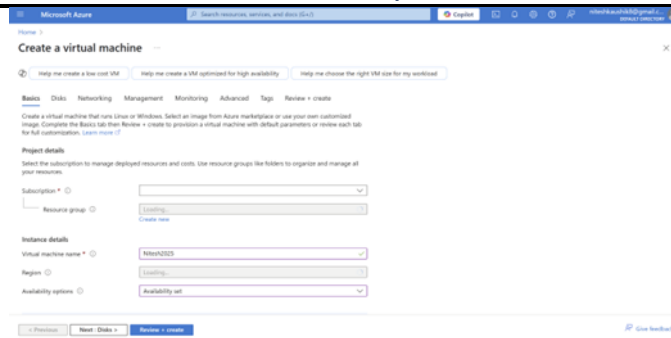


Fig. 2 Microsoft Azure VM creation process

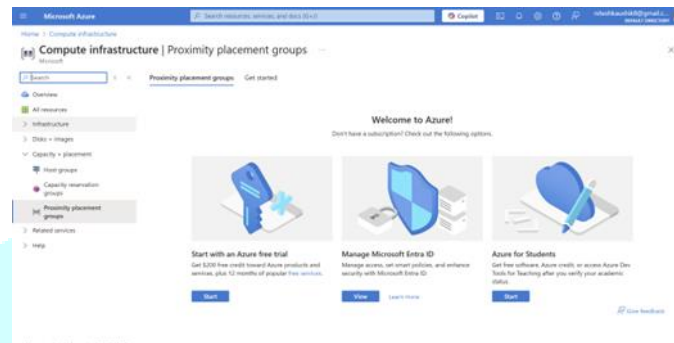


Fig. 3 Microsoft Azure VM Placement process

Fig. 2 shows basic process of VM creation in Microsoft Azure my portal, which include 08 steps (Basic, Disks, Networking, Management, Monitoring, Advanced, Tag, and Review & Create and Fig. 3 shows the details of VM placement with 03 options in groups (Host group, Capacity reservation group and Proximity placement groups), basically these placement groups is a logical grouping which are making Azure total resources are actually located near to each other. They are useful for workloads, where low latency is a requirement.

V. PERFORMANCE EVALUATION

The concern of our projected new MBO-VM algorithm is to secure energy and enhance resource use has been equated with other VM placement algorithms in this concern literature.

The CloudSim toolkit [5] was used to measure our proposed new MBO-VM algorithm. CloudSim is the most preferred simulation tool among cloud researchers, and most cloud researchers use it extensively to develop VM placement algorithms.

TABLE 1 VM CONFIGURATIONS USED IN THE CONCERN DATA CENTER

Nos.	VM type	MIPS	Num cores	RAM (MB)	VM size (GBs)
1	Type 1 [Big]	2300	2	1740	2.5
2	Type2 [Small]	800	1	1740	2.5

TABLE 2 ENERGY CONSUMPTIONS OF THE CONCERN DIFFERENT POPULATION STRATEGIES USING PM TYPE1 FOR S1

No. of VM	New MBO-S1 (Best)	New MBO-S1 (Worst)	New MBO-S1 (Mean)	New MBO-S1 (SD)
100	23.44	24.93	23.64	0.80
200	45.21	46.86	46.32	0.90
250	57.34	58.63	58.42	0.96
300	70.21	73.47	72.48	1.65
400	92.34	95.32	94.23	1.77

TABLE 3 ENERGY CONSUMPTIONS OF THE CONCERN DIFFERENT POPULATION STRATEGIES USING PM TYPE1 FOR S2

No. of VM	New MBO-S2 (Best)	New MBO-S2 (Worst)	New MBO-S2 (Mean)	New MBO-S2 (SD)
100	22.31	24.23	23.95	0.70
200	44.76	45.23	45.10	0.76
250	56.46	57.37	56.75	0.82
300	68.72	70.54	69.21	1.21
400	91.87	93.98	92.56	1.43

TABLE 4 ENERGY CONSUMPTIONS OF THE CONCERN DIFFERENT POPULATION STRATEGIES USING PM TYPE1 FOR S3

No. of VM	New MBO-S3 (Best)	New MBO-S3 (Worst)	New MBO-S3 (Mean)	New MBO-S3 (SD)
100	20.15	20.85	20.52	0.18
200	43.24	43.83	43.54	0.12
250	54.78	55.12	54.84	0.14
300	64.72	64.94	64.85	0.08
400	89.55	90.98	89.65	0.08

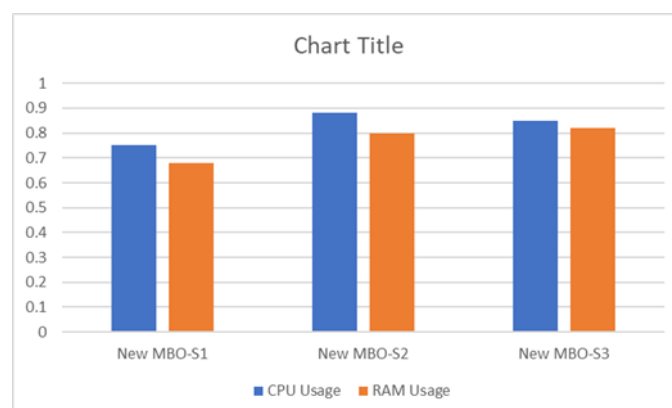


Fig. 4 :- CPU and RAM use for various population plans.

Table 1 shows all the various types of virtual machines used to evaluate the proposed VMP solution. All experiments are made using an ASUS laptop with windows 10 OS and the three experiments are directed to evaluate the effectiveness of the proposed new MBO VM solution. Table 2,3, and 4 shows the energy consumption of the concern different population strategies using PM type for S1, S2 and S3 and Fig. 4 is related to CPU and RAM use for various population plans.

Security features for VM placement in cloud will be secure VM isolation, encrypted VM images, access control and identity management, secure VM migration.

VI. CONCLUSION

Due to enhancement in cloud computing main focus is on the concern cost of the related system. So, in this paper we proposed New MBO VM concept for variably allotting virtual machines to its related PMs on its present load and its concern features. By using our concept there will be a decrement in its related consumption of energy with its concern resources. To calculate performance of the given concept, we are using CloudSim toolkit. Using data centers to the best is being given in its output of simulation. In coming future topics related to machine migration and other issues can be worked on also its related requests may be used in medical field.

REFERENCES

- [1] Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility Rajkumar Buyyaa,b, Chee Shin Yeo^a, Srikumar Venugopala, James Broberg^a, Ivona Brandic^c
- [2] Protecting Private Cloud Located within Public Cloud Hongli Zhang¹, Lin Ye¹, Xiaojiang Du², and Mohsen Guizani³
- [3] Gao Y, Guan H, Qi Z, Wang B (2012) An ant colony system algorithm for the problem of server consolidation in virtualized data centers. J Comput Inf Syst 8(16):6631–6640
- [4] Ghetas M, Yong CH (2018) Resource management framework for multi-tier service using case-based reasoning and optimization algorithm. Arab J Sci Eng 43(2):707–721
- [5] Calheiros RN, Ranjan R, Beloglazov A, De Rose CA, Buyya R (2011) CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms. Softw Pract Exp 41(1):23–50