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Energy efficient cloud computing using secure virtual machine migration: A taxonomy

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Abstract

Numerous cloud service enterprises have launched a broad variety of cloud services. Several businesses and people use these programs on a daily basis. The efficiency of cloud service depends on efficiency of the service providers. It is also important for cloud customers to analyses and review the available cloud resources thoroughly to pick the best cloud service. Secure virtual machine placement is a big issue during the migration of virtual machines in cloud computing. Secure virtual machine migration maximizes the throughput and reliability of the system and reduces Service Level Agreement (SLA) violations. This article focuses on secure virtual machine migration with energy-efficient techniques

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1. Introduction

The Cloud is a network of interconnected devices that contains multiple integrated computing resources [1]. Placement of VMs in cloud environments without a security plan may enhance the opportunity for attackers to steal sensitive information [2]. Securing cloud data in a shared environment is a crucial challenge for the IT sector today. Secure VM placement on the host system that is running in the cloud must be the main focus in a virtual environment [3]. The relocation of a virtual machine from one host to another is referred to as "virtual machine migration.". Every work will take the same amount of time to transfer between virtual machines as it does in cloud computing [4]. Server consolidation is a potential approach in Data Centres (DCs) that allows for more effective use by reducing the number of physical servers required by an organisation. By decreasing data center usage, the cloud helps to reduce CO_2 emissions, reduce carbon footprints, and improve energy efficiency [5]. Figure 1 depicts the server consolidation that is intended to be achieved through VM task allocation.

During the starting assignment of incoming requests to the smallest possible number of servers: When a request arises for the creation of a virtual machine (VM) (a server instance with a virtual replica of the host configurations) is received, it is ensured that these requests are distributed across a smaller range of active servers. So, consolidation becomes possible, and the fewest number of servers can handle the most requests

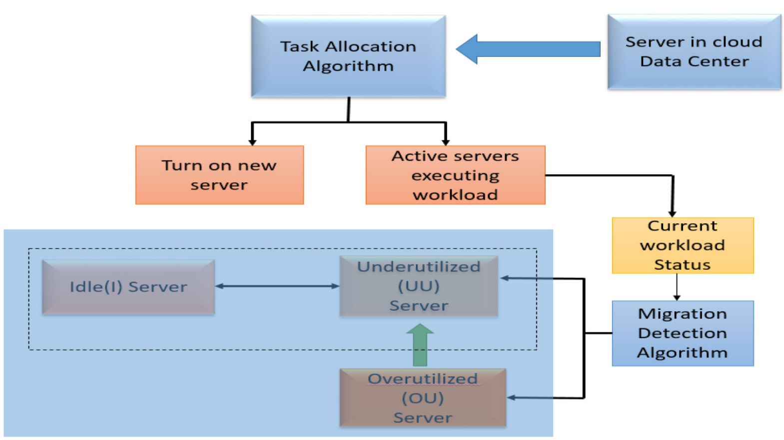

Figure 1

Cloud Server consolidation techniques

Between tasks, identify servers that are over- or underutilised by executing VM migration: There may be instances where a few VMs have been released after finishing their task in a cloud system, causing the burden of servers to vary. Also, some tasks that use less resources at first may use more resources in the future. Between tasks, identify servers that are over- or underutilised by executing VM migration: There may be instances where a few VMs have been released after finishing their task in a cloud system, causing the burden of servers to vary. Also, some tasks that use less resources at first may use more resources in the future. Researchers came up with a new way to think about secure load balancing and also made sure that the right number of physical machines were used for the deployment. The main goal of this research is to reduce threats by making it less likely that attackers will work together with their targets. Authores looked at how hard it is to get co-residency with three of the most important and widely used VM allocation policies. Additionally, it shortens the makespan time and is flexible in the dynamic network environment [6].

Vector dot is a new set of rules of load balancing, which utilizes storage, community switches and servers, in a nimble data center for managing the resource loads' multi dimensionality and the data center's hierarchical complexity. Virtualization technologies of storage and server constitute the data center.

2. Energy Efficiency in Cloud Computing:

Cloud computing aims to accomplish excellent computation while utilising the least amount of energy on cloud networks. A simulation is relevant and considerate of the environment, which is defined as energy efficient. It tries to maximise the efficiency of the utilisation of electricity and the conservation of energy, as well as to decrease the economic burden of servers and, and also reduce a carbon dioxide emission. Every cloud provider might have multiple data centres, and each one might offer a variety of emission resources and services.

Energy Efficiency is Required in Cloud Data Centers

Research to improve data centre energy performance and efficiency in the year 2010, with the purpose of improving dynamic resource allocation algorithms to allow for the alliance between different data centre structures and consistently to enhance data center energy performance and efficiency [7].

3. Approaches to energy efficiency and security challenges in the cloud computing environment:

3.1 *Migration of VM*

Migrations of virtual machines are done for many different reasons. This can be done to get a better balance of the current work load across the available servers, to save power by turning off some servers, to perform maintenance on servers or to upgrade some machines, or for other reasons. Also, virtual machine migration is used to make sure that users have access to a lot of data even if a server goes down unexpectedly. Migration of VMs is also used to get ready for a disaster. For this process, the disaster recovery site is set up with parallel resources, specialized network connectivity equipment, and high-speed WAN links.

Let P Static be the amount of power that a server needs to do all of the tasks that are needed for a VM to be operational. P Virtual is the amount of dynamic power used by VMs hosted on that machine. These are some possible ways to describe how much power the whole server needs [8].

$$P_{phys} = P_{Static} + \sum_{i=1,\ldots,m}^{n} p(VMi) = P_{Static} + P_{Virtual} \tag{1}$$

where P (VM i) denotes the energy consumption of the i-th virtual machine and m denotes the total number of virtual machines that are available. Several techniques are used to estimate this value [9].

3.2 *Energy calculation*

Let t_{idle}^{i} be the amount of time, an idle state defined by the i-th machine. Let t busyi be the amount of time the machine spends doing actual computing tasks. Let p_{idle}^{i} be the amount of power a machine required for running of an idle state. And let p_{busy}^{i} be the required power for a machine to perform computational activities. It is believed that the power needed to carry out security-related tasks will be the same as in busy mode.

Where "task" represents the tasks that have been allocated to VM_i, and t_{sec}^{i} stands for time spent processing just [11]

4. VM Scheduling Method:

4.1 *Ant Colony Optimization (ACO)*

This algorithm pure behavior substantially contributes to the determination of the best path between colonies and food sources. The "ant system" was the name given to this technology [12].

4.2 *Artificial Bee Colony (ABC)*

A colony of bees is set up so that each bee works cooperatively to find food sources, and this knowledge is used to make decisions about how to explore the search space [13]. Energy-aware scheduling can allow you to manage resources more efficiently and get the most out of them in the cloud. Virtualization is a method of consolidating servers in order to consume minimal energy and reduce completion time. [12].

4.3 *Genetic Algorithm (GA)*

To solve the problem of overused and underutilised virtual machines, a genetic algorithm is applied. Using a genetic algorithm in cloud environment overcome science-based issue [14], [15]. A genetic algorithm makes use of the optimal solutions from finalized searches that consider additional areas of the solution space [12].

In maximal meta-heuristic algorithms, Figure 2 is depicting the analysis of result among GA, ACO and ABC. In the case of a GA, load balancing is considered as a scheduling goal. The parameters of reliability (2%) and resource utilization (7%) have received minimal consideration.

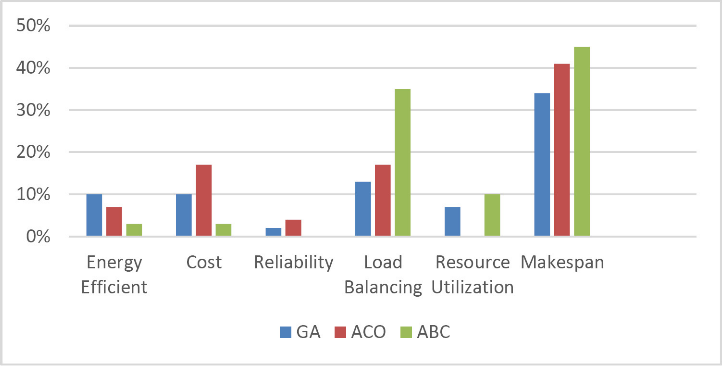

Figure 2

Comparison analysis of algorithm on the basis of GA, ACO and ABC

ACO execution time is 41%, costs is 17%, and load by 17%. As a result, more effort is needed in the fields of energy efficiency and reliable resource provisioning. Several studies have optimized the make span by 45% and balanced the load by 35% using the artificial bee colony method [12].

5. Discussion and Conclusion:

One of the critical challenges with cloud data centers is energy efficient. Data centers can decrease the amount of energy by using the energy efficient algorithms and secure virtual machine migration. One of the major components of creating a dynamic cloud resource management system that is energy-efficient is virtual machine consolidation. This study summarized the advantages of energy efficient algorithms, including increase the throughput, reliability of system and decreases the Service level agreement violations. In order to offer effective resource usage in the cloud environment, a load balancing approach based on genetic algorithms has been created. Secure virtual machine migration can manage the reliable migration of machines among the data centers.

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