International Academic Institute for Science and Technology

International Academic Journal of Science and Engineering
Vol.11, No.1, 2024, pp.09-14.

ISSN 2454-3896

International Academic Journal of Science and Engineering

www.iaiest.com

A Dynamic Workflow Scheduling Method based on MCDM Optimization that Manages Priority Tasks for Fault Tolerance

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Abstract

Because it offers efficient on-demand service delivery over the internet, cloud computing has become more and more popular. An architectural model for cloud computing energy management is provided by the suggested Ant Lion algorithm. Virtual Machines (VMs) in cloud systems are assigned to hosts based not so much on their overall and long-term use, but rather on their immediate resource consumption, including RAM availability. The placement and scheduling processes are frequently computationally demanding and have the potential to affect the performance of deployed virtual machines.

In this research work, we offer a strategy that considers the historical resource use of virtual machines (VMs) over time while scheduling them in the cloud. Our goal is to use the Ant lion approach to schedule virtual machines (VMs) in a way that maximizes performance by evaluating the utilization levels of prior VMs. The goal is to reduce the degradation of performance brought about by Cloud administration tasks like as virtual machine deployment, which might impact systems that have already been installed. Furthermore, congested virtual machines (VMs) sometimes take up resources from nearby VMs, increasing the VMs' actual CPU use. Our results show that by learning and adjusting to system behavior over time, our strategy outperforms conventional instant-based physical machine selection. We offer the idea of scheduling virtual machines (VMs) using resource monitoring data from past VM resource use. By using the Ant lion classifier, four fewer physical machines are needed.

Keywords: Cloud Data Centre, Virtual Machine, Energy Consumption.

DOI:10.71086/IAJSE/V11I1/IAJSE1102
Received:28 November 2023/Accepted: 24 December 2023/Published: 06 January 2024

Introduction

The computational paradigm of the future is cloud computing, which is quickly taking the lead in distributed on-demand computing. By using virtualization, it is evolving into a fundamental basis for several web businesses. Concurrently, one of the most prosperous company models of the contemporary period is e-company, made possible by the internet. Like traditional utilities like water, computing is becoming a commodity service to meet the needs of internet-enabled organizations. Regardless of where they are located or how they are provided, customers may receive services according to their requirements. Utility computing has been promised by several computer paradigms; cloud computing is one trustworthy paradigm in this respect. A front end and a back end linked by an intranet or the internet make up the architecture of cloud computing. Thin clients, fat clients, and mobile devices are examples of client devices that make up the front end. To access the cloud computing infrastructure, these devices need an interface and apps. The back end consists of a centralized server that oversees the cloud system, as well as several servers and data storage systems. In addition, this central server keeps an eye on all traffic and answers client requests right away.

Cloud Data Center

A cloud data center is a cutting-edge configuration designed to manage and store enormous amounts of digital data, applications, and services in an effective and scalable manner. Unlike traditional on-premises data centers, cloud data centers utilize virtualization and cloud computing technologies to provide online access to resources from a distant location. As a result, there is no longer a need for significant physical hardware maintenance, allowing businesses and people to access, grow, and extend their IT services and infrastructure as required. Cloud data centers, which provide trustworthy, flexible, and reasonably priced solutions for a range of computing needs, including handling complex applications and services and processing and storing vast volumes of data, are largely responsible for driving the digital era.

Virtual Machine

A virtual machine, sometimes known as a VM for short, is an essential part of contemporary computing that has completely changed how we organize and use hardware resources. A virtual machine is essentially a software-based simulation of a real computer system, replete with an operating system and software of its own. It permits the operation of numerous virtualized instances on a single physical server, facilitating flexible computing environment management, effective resource usage, and task segregation. Because they allow multiple operating systems and applications to run on a single piece of hardware, virtual machines are widely used in data canter's, cloud computing, and development environments. This facilitates hardware consolidation and makes it easier to test, develop, and deploy a wide range of software solutions. This technology, which improves computing environments' scalability, security, and general efficiency, has emerged as a key component of contemporary IT infrastructure.

Energy Consumption

Energy consumption is a crucial aspect of both our daily lives and the world economy. It encompasses the amount of energy required to power our homes, companies, transportation, and other technological equipment. It is an essential part of economic expansion and a key factor in determining how sustainable our activities are and how they affect the environment. Addressing environmental concerns such as resource conservation and climate change requires a shift in the way we produce, distribute, and use energy. Understanding and managing energy consumption is necessary to achieving a more sustainable future. This involves choosing energy sources, efficiency levels, and conservation strategies that minimize adverse environmental consequences and strengthen the energy infrastructure.

Literature Review

Complete Data Privacy Preservation and Identity-based Remote Data Integrity Checking for Cloud Storage

A novel method for remote data integrity checking (RDIC) that emphasizes identity-based (ID-based) protocols was put out by the authors, Yong Yuet al. The proposed protocol reduces complexity and costs associated with PKI-based RDIC schemes by using key-homomorphic cryptographic primitives, in contrast to current RDIC protocols that depend on pricey public key infrastructure (PKI). With zero knowledge privacy for third-party verifiers and protection against rogue cloud servers, the study formalizes the ID-based RDIC protocol and its security architecture. Crucially, the suggested technique keeps the verifier in the dark about any information about the stored data. It has been shown via extensive security research and implementation that the recommended protocol is both safe and useful in practical settings. The study also establishes the security model for complete data privacy and

soundness, two essential components of secure cloud storage. By presenting a unique application of this strategy, the authors show how well it works to provide complete data privacy and soundness. The recommended protocol's viability and efficiency are further confirmed by the results of its execution and numerical analysis. [1].

Cloud Computing Service Level Agreement: An Inquiry

This research, which explores how cloud computing affects global resource accessibility, was suggested by UsmanWaziret.al. Cloud computing provides on-demand services and scalable designs to businesses across several industries. Cloud services do, however, come with some drawbacks. Several approaches have been put out to deal with these issues, especially in relation to SLAs (Service Level Agreements) in cloud computing. The goal of this research is to address the current problems with performance, customer happiness, security, profit, and SLA breaches by looking at several SLA models in the context of cloud computing. Additionally, the article evaluates current SLA models in various cloud service formats, including SaaS, PaaS, and IaaS, and explores the architecture of SLA in cloud computing. The advantages and drawbacks of the existing models are examined using tables. The study comes to a close with a summary of the results and a recommendation. All things considered, this study sheds light on the use of SLA models in cloud computing settings, emphasizing the value of security, fines for SLA breaches, customer confidence, and performance enhancement when creating SLAs between clients and cloud service providers. [2].

A Secure Virtual Machine Resource Allocation in Cloud Reviewing Game-Theoretic Approaches

Priti Narwalet suggested this study article, which is centered on cloud computing. The dynamic and ever-evolving platform of cloud computing makes use of virtualization technologies. Virtualization makes it possible for each application to run independently in a separate environment known as a virtual machine by separating hardware system resources in software inside the cloud computing environment. The hypervisor then assigns these virtual computers to various users, all of whom are housed on the same server. Cloud computing provides a number of security issues in addition to its many benefits, which include resource sharing, cost-efficiency, high-performance computing, and cheaper hardware expenses. These risks may be present on the virtual machines themselves or, via the virtual machines hosted on the hypervisors, indirectly on the hypervisors. This study suggests using Game Theoretic approaches to mitigate these security vulnerabilities. Because cloud users make logical, independent decisions, game theory may act as a safeguard by having each participant compete for the best possible solution in a safe way.Furthermore, in addition to security and privacy, it's essential to take into account other factors like efficiency and optimization since various users in a cloud environment have varied resource needs. As such, this research does a comparative analysis of many game theory-based models. The goal of this research is to provide readers a basic grasp of the security issues users are facing and the strategies that have been used in the past to distribute resources fairly. [3].

Presenting in Owl Access Control Policies Based on Attribute

This study was suggested by Nitin Kumar Sharma et al. While retaining the benefits of the more established access control models (DAC, MAC, and RBAC), attribute-based access control (ABAC) models aim to solve their shortcomings. Access control based on entity generic properties is made possible by ABAC. A lot of organizational security policies base their access choices on qualities [8]. Web Ontology Language (OWL) is a formal language that may be used to process and represent ABAC models adequately. In this study, we created models, domains, data, and security rules using OWL, and we used a reasoner to decide which activities were acceptable. In order to enforce rules, our method entails expressing the ABAC model using OWL and utilizing the EYE reasoner to infer logical relationships and derive access rights for requested actions. In this work, the Attribute Based Access Control model is expressed using Web Ontology Language (OWL). [4].

A Game Theoretical Analysis of Auditing A Cloud Provider's Compliance with Data Backup Requirements

This paper, which tackles the security issues raised by developments in cloud computing, was offered by Ziad Ismailet al. The major focus of these difficulties is maintaining the availability, confidentiality, and integrity of data that is outsourced. A Service Level Agreement (SLA) is usually signed by the client and the cloud provider to handle these issues. To guarantee redundancy, it is essential to confirm that the cloud provider adheres to the data backup guidelines specified in the SLA [6]. Diverse security protocols are used to ensure the availability and integrity of data that is outsourced. The customer may choose to conduct the evaluation of data availability themselves, or they may assign the task to a third party, the verifier [7]. The price of data verification, however, might deter clients from doing routine inspections. Game theory may be used to examine how the cloud provider and verifier interact in order to identify the best data verification strategy. The issue is stated as a two-player non-cooperative game in this study. We analyze a case in which the size and sensitivity of each data item determine how

many times it is reproduced. We can forecast the actions of the cloud provider and the verifier at the Nash Equilibrium by examining their strategies [9]. Lastly, we provide our methodology for evaluating the model's parameters and provide numerical validation of our model using a case study. Using a non-cooperative game model to represent the interaction between the cloud provider and the third-party auditor (TPA), this research focuses on guaranteeing data availability when it is outsourced to a cloud provider. [5].

Existing System

Cloud computing's popularity stems from its convenient on-demand service delivery via the internet. However, managing and allocating cloud resources has become increasingly challenging due to the growing number of requests and the diverse criteria used to utilize these resources. This includes considering the user's Quality of Service (QoS) preferences, ensuring proper load balancing, and adapting to the ever-changing cloud environment. Traditional static load balancers, which distribute requests based on predetermined ratios of available resources, are no longer effective as server capabilities evolve. Extensive research has shown that existing scheduling algorithms fail to provide an adaptive approach that considers both load balancing and maximizing quality-of-service requirements. To address this issue, the authors of a recent study propose a novel adaptive approach by combining the compromise ranking method (VIKOR) with the best-worst multi-criteria decision-making method (BWM). This approach prioritizes tasks using the VIKOR method as a decision-maker. The validity of this method is confirmed through numerical tests, and its performance is evaluated against alternative scheduling techniques using multiple performance metrics. Simulation results consistently demonstrate that the proposed method outperforms its competitors in terms of throughput, makespan, waiting time, virtual machine (VM) utilization, and VM usage cost in all simulated experimental scenarios.

Proposed System

The recommended approach transforms cloud data center energy management by combining the Ant Lion algorithm with machine learning. Our solution will create sophisticated machine learning models that can precisely predict thermal conditions by using historical data on temperature, server loads, and cooling system performance. We proposed the Ant Lion Algorithm, a dynamic system that continually collects relevant variables such as the thermal states of cloud servers together with data on workload, ambient temperature, and fan speed. Using the collected data, the system trains a machine learning model to predict the cloud servers' temperature state. The Ant Lion algorithm is then used by the system to arrange virtual machines on servers in a manner that optimizes energy savings and maintains the servers' temperatures within acceptable ranges.

VM Scheduling

Through the gathering of real-time dataset monitoring data and the examination of both physical and virtual resources, the suggested technique improves the VM selection stage. Our goal is to minimize the effect on overall performance by optimizing VM scheduling by using factors relating to real VM utilization levels. The optimization techniques make use of analytics to reduce performance losses and increase the use of already installed virtual machines (VMs). Real-time data on the consumption of virtual machine resources is gathered by a monitoring engine. This engine periodically collects system data and saves it for further processing in an online cloud service. Data is gathered and momentarily stored in a local file at certain times, such once per second.

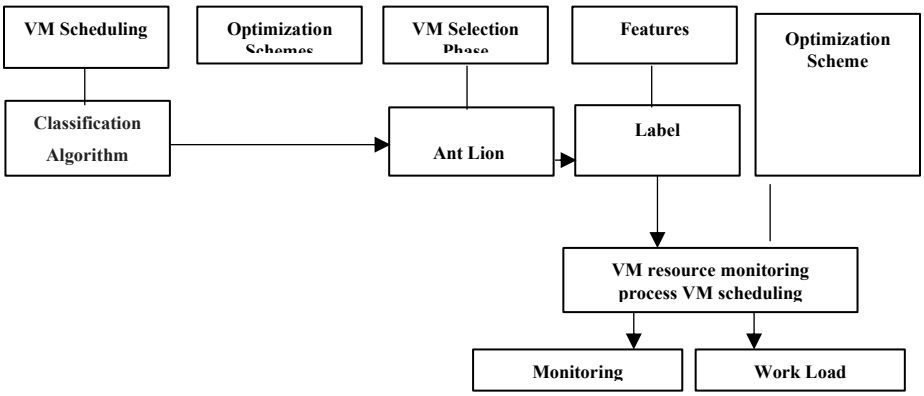


Fig. 1: Block Diagram

Classification Algorithm

When considering supervised machine learning algorithms for classification, the input dataset has to be labelled.

Ant Lion

The ant lion algorithm maintains track of a population of solutions as it is population-based. Similar to its insect counterpart, the Ant Lion Algorithm offers a unique approach to optimization. This method, which imitates how ant lions build and use conical tunnels to catch prey, provides a powerful tool for addressing difficult optimization problems across a range of fields. When looking for the optimum solutions, ALA's ability to balance exploration and exploitation makes it a particularly good fit for scenarios when more traditional optimization methods may not be sufficient.

Optimization Scheme

These optimization techniques aim to ascertain the virtual machine's (VM) importance by analyzing how the VMs use their resources. This will offer information on the state of previously deployed virtual machines (VMs), including whether or not a workload is running. To this end, we provide two optimization methodologies. The ant lion is used to categorize the virtual machine's current condition according to how it is using its resources. First, data about how the virtual machine is utilizing its resources is gathered and tracked. Next, machine learning techniques such as Ant Lion are used to classify the acquired data.

Results and Discussion

An open-source tool for building both private and public clouds, Cloud Sim, is highlighted. Until the maximum number of virtual machines is reached, the Cloud Sim default configuration installs virtual machines by selecting the host with the most RAM. Without considering the hosts' overall and long-term utilisation, virtual machines (VMs) are allocated to them according to their immediate resource usage (e.g., the hosts with the most RAM available). Deployed virtual machines' performance is impacted by the scheduling and placement processes, which are often computationally demanding. Because of this, the conventional VM placement technique ignores the resource use levels of prior VMs. By using a VM scheduling technique, this is resolved.

Table 1: Comparison Table

algorithm	accuracy
proposed	88
existing	75

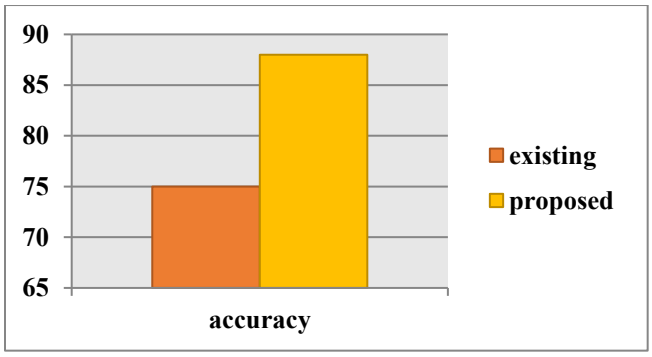


Fig. 2: Comparison Graph

As can be seen from the table, the accuracy of the proposed technique, which is 88%, is much higher than that of the present algorithm, which is 75%. The recommended approach outperforms the present algorithm by 13 percentage points, according to the accuracy data, which also demonstrate how successful the algorithms are in their specific conditions. This performance difference demonstrates the potential advancements and improvements that the proposed algorithm may bring about, demonstrating its ability to provide more accurate and reliable results than the existing methodology.

Conclusion

In order to plan work, several virtual machine placement strategies were used, wherein physical machines were chosen according to system parameters like CPU, memory, and bandwidth consumption in a cloud system. However, real-time VM resource utilization levels are not taken into consideration by the existing VM placement technique. In this section, we provide a novel method for placing virtual machines (VMs) that makes use of prior VM use knowledge. Our prediction of VM resource use allows us to arrange VMs based on training data from machine learning models (ant lion models) and observation of VM consumption. We also present a computational learning strategy that improves the PM selection phase by evaluating past VM resource use using historical data, and an algorithm that permits VM placement depending on both PM and VM consumption levels. Furthermore, we provide a real-time virtual resource monitoring method for virtual machine deployment that uses machine learning models to train and learn from historical VM resource use. As such, we presume the presence of a monitoring engine that furnishes facts about resource consumption.

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