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A Systematic Review to Address Noisy Neighbor in the Public Cloud

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***Abstract*— The multitenant cloud architecture has many difficulties, one of which is the unpredictability of performance brought on by resource needs. The notion of multi-tenancy is well adopted in cloud and has taken it to a new height, but with increase in traffic, the problem of noisy neighbor originates that puts a restriction on its adoption. Therefore, a strategy needs to be devised that can address the issue of noisy neighbor without compromising upon the other SLA parameters and performance indicators. Unpredictable resource availability and usage or noise can interfere with Optimal scheduling in cloud resource scheduling, especially when resources or workloads are scheduled closely together. Current techniques for handling neighbor noise may not be sufficient and the impact of different types of noise on optimization results is unclear. The suggest system actively monitors the resource exhaustion of tenant applications and based on which can apply capabilities like assigning dedicated namespace or Utilizing a Resource Quota that can be defined on each namespace and has fixed CPU and Memory allocation will also help to reduce the noisy neighbor issue. This quota can be changed as needed to increase or decrease the resources available to each application, ensuring that no application can use up all of the cluster's compute or storage resources to the point that it interferes with neighboring applications. Making sure all applications running on a shared infrastructure have access to the resources they require at the appropriate time is the real answer to quieting loud neighbors. This is made feasible by carefully planning and sizing the infrastructure of the data center. It ought to be capable of supporting the total load at all times and have provisions for dynamic resource allocation in response to demands. Future research could focus on developing more effective noise handling techniques and exploring the impact of different types of noise on scheduling accuracy.**

***Index Terms*— Cloud Computing, Multitenant, Noisy neighbour, Load balancing, VM Migration, Scheduling.**

I. INTRODUCTION

Researchers have recently paid a lot of consideration to the field of cloud information technology that is a delivery paradigm for information technology assets including hardware, data storage, and apps through the internet [1]. One of the main reasons for this interest is the potential for cloud computing to offer scalable, cost-effective solutions for individuals and organizations [2]. By utilizing cloud computing services, businesses can avoid significant investments in IT infrastructure and can access computing resources on-demand as needed. In addition to its cost savings, cloud computing has also been shown to improve operational efficiency, network infrastructure and reduce downtime [3]. For instance, the use of cloud-based disaster recovery and backup solutions has become

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increasingly popular due to its ability to quickly restore data and services following an outage [4].
Despite the benefits of cloud computing, designing effective cloud models is crucial to ensure that organizations can achieve their desired outcomes while minimizing potential risks [5]. Among the challenges that cloud computing faces are data privacy, security, performance, and regulatory compliance [2]. A resource-hungry application uses more resources than it should due to the scalability of the cloud, which affects the co-tenant apps. As a result, since it depends on the other customers of the service, a repercussion of the multiuser cloud architecture is the complete absence of predictability of the performance of a given VM.

II. Related Work

Literature review related to above Problem is discussed in Table 1, Table 2 and Table 3 below:
The noisy neighbor Problem can be resolved by transfer the application to some other node or reserve the resource quota that is load balancing or by studying the existing multitenancy techniques like MI-SUAGame, MTIDaaS etc.
The most relevant papers are listed below:

TABLE I. VIRTUAL MACHINE MIGRATION METHODS

S. No.	Year	Paper	Technique	Simulation tool	Results
1	2019	[26]	KBR (knowledge-based reduction) technique	CloudSim tool-kit	The observation depicted that the result of the presented technique alleviating the energy utilization and optimizing the infringement of service level agreements to attain superior efficiency.
2	2022	[27]	A novel FRBS (fuzzy rules-based system) technique	Cloudsim	The outcomes of experiment revealed that the investigated technique was effectual concerning sustainability and led to preserve the QoS (quality of service) with respect to execution time.
3	2022	[28]	Aware Genetic Algorithm First Fit (AGAFF)	MATLAB language and Octave open-source software V4.4	Evaluations exhibited that the introduced algorithm was capable of diminishing the energy usage by 61% and it consumed least execution time and cost in contrast to other algorithms.
4	2021	[30]	A Virtual Machine Migration Strategy Based On The Three-Way Decision (VMM-3WD)	CloudSim	The experimental outcomes reported the applicability of the projected algorithm for diminishing the energy utilization while migrating the VM (virtual machine) and energy consumed by DC (data center) to meet the SLA.

TABLE II. LOAD BALANCING TECHNIQUES

S. No.	Year	Paper	Technique	Simulation tool	Results
1	2022	[32]	Markov process model-based load balancer	CloudSim	This model had generated superior results concerning makespan, average utilization, degree of imbalance, and response time.
2	2021	[33]	Predictive Priority-based Modified Heterogeneous Earliest Finish Time (PMHEFT) algorithm	NetBeans, Java, and WorkflowSim software	The presented algorithm assisted in enhancing the efficacy and mitigating the energy usage as compared to the traditional methods.
3	2020	[34]	A new hybrid model which employed file type formatting	CloudSim 4.0 and MS Excel 2016	The experimental results proved that the developed model was robust and scalable as compared to others.
4	2020	[35]	Data Files Type Formatting (DFTF)	CloudSim 4.0	Simulation results revealed that the projected algorithm enhanced the throughput up to 7%, response time by 8.2%, migration time up to 13%, energy usage of 8.5%, and average execution time up to 9%.
5	2022	[36]	Deep Reinforcement Learning with Parallel Particle Swarm Optimization (DRLPPSO)	Google Colab with the Python environment and TensorFlow	This algorithm yielded an accuracy of 83.33% in comparison with other methods to balance the load.

TABLE III. MULTI-TENANCY TECHNIQUES

S. No.	Year	Paper	Technique	Simulation tool	Results
1	2022	[37]	A game-theoretic approach, namely MI-SUAGame	Nash equilibrium	MI-SUA Game in terms of efficacy and efficiency out performed a baseline technique and the most recent approach.
2	2022	[38]	Structure for multi-tenant intrusion detection as a Software as a service (MTIDaaS)	CloudSim	For both suppliers and tenants, it provided security as a service (SecaaS) with high degrees of mobility, flexibility, and cost. The results of the trial show that MTIDaaS provided simple IDS integration with little virtualization overhead and no influence on HTTP response time.
3	2021	[39]	XBAC is a revolutionary unified access control mechanism designed for heterogeneous multi-tenancy cloud environments.	OpenStack.	By restricting unauthorized users' access to the resources of multi-tenancy cloud services, the suggested model adhered to the requirements of the context for heterogeneous access models.
4	2020	[40]	A guided understanding of the abnormality spreading routes	Openstack	Real data were used in the experiment, and the findings show promise, demonstrating the effectiveness of the suggested strategy.
5	2015	[41]	Affinity-aware scheduler, Fuzzy logic	Openstack	Our affinity-aware fuzzy scheduler lessens application interference, enabling more predictable performance and, as a result, safer overbooking, according to a testing utilizing a mix of online services and batch applications.

III. OBSERVATION

Based on the literature survey conducted so far, following are the observation

The notion of multi-tenancy is well adopted in cloud and has taken it to a new height. But with increase in traffic, the problem of noisy neighbour occurs that puts restriction on its adoption[42-43]. Therefore, a strategy needs to be devised that can address the issue of noisy neighbour without compromising performance indicators.

However, current optimization models often assume static environments and are unable to adapt to the dynamic nature of cloud computing. To address this challenge, there is a need to design a scheduling framework that can incorporate intelligent decision-making capabilities and adapt to changing environments. Further research can develop an adaptive scheduling model that can make informed decisions about when to migrate from one node to another in case of high traffic, when there is a need to apply resource quota to the nodes or borrowing resources from some other nodes. This has the potential to significantly improve the efficiency and effectiveness of cloud. This has significant implications for industries such as healthcare, finance, and scientific research, where the use of cloud computing can help improve outcomes and accelerate progress.

Therefore, there is a pressing need for researchers to focus on developing an adaptive scheduling model that can incorporate optimization approaches with intelligent decision-making capabilities to achieve efficient and cost-effective resource management in cloud computing. Such research can contribute significantly to the advancement of the field and pave the way for more sophisticated and innovative cloud-based applications.

Some important outcomes taken from literature are as follows:

- Multi-tenant intrusion detection framework service will offer mobility, flexibility and affordability both for supplier and tenant.
- The XBAC access control model, a revolutionary unified access control model for heterogeneous multi-tenancy architectures in the cloud environment, which restricts unauthorized users' access to the resources of multi-tenancy cloud services.Real time data analysis is used for demonstrate the effectiveness of strategy.
- Affinity-aware scheduler, fuzzy logic will avoid interference, give predictable performance.

IV. Conclusion

Noisy neighbor phenomenon is one of the challenges in cloud computing. The various schemes are already been proposed for detecting noisy neighbor in cloud environment. The already proposed techniques is reviewed in this paper and it analyzed that already proposed technique has some major issue like economic damages could occur if this abnormality is not found and fixed right away. The resource scheduling technique should be energy efficient and also has low response time. Testing additional kinds of anomalies, including overload in intricate infrastructure, should be part of future effort.

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