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Enhanced Multi-Objective based Resource Allocation using Framework Creation in Cloud Computing

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Abstract: ***On-demand applications are to be distributed seamlessly in a cloud computing environment, depending on the user's needs. Service distribution is an interesting facet of cloud technology study. This is a mechanism that helps users to benefit from cloud providers as a metered utility in the cloud. The cloud administrator is responsible for efficiently allocating available resources to the execution tasks, thus improving the performance of the system while reducing energy consumption and providing reliable resources most of the existing research work only take one aspect and neglects their interconnections. Thus, a dynamic approach is built to solve this limitation by leveraging all the QoS output to make reasonable use of the capital. The technique utilized is an algorithm for load balancing, depending on the actions of bees. For this, we provide real-time eucalyptus cloud-based performance with network design and related operations being conducted and evaluated. Innovative tests show the effectiveness of the algorithm in terms of computational time, reaction time, makespan, load variability, and level of imbalances.***

Key Terms: Cloud computing; On-Demand Resources; VM scheduling

I. INTRODUCTION

Cloud computing has become a replacement age technology that possesses huge potentials in enterprises and markets. Cloud computing emerges as a replacement computing paradigm that aims to supply reliable, customized and QoS (Quality of Service) guaranteed computing dynamic environments for end-users. Distributed processing, multiprocessing, and grid computing together emerged as cloud computing.The crucial principle of cloud computing is that the user data isn't stored locally but is stored within the info datacenter of the internet. Since VMs are created by the hypervisor, consistent with the user requests, users buy the resources used only. VM scheduling maybe a job that is critical within cloud computing, this may be a mechanism that maps users' VM. The tasks are often completed during a minimum time consistent with the user-defined time. In [2] to gauge a scheduling algorithm that's an efficient technique for scheduling virtual machines between servers. When some VMs are overloaded and remaining are underloaded, at that time the load has got to be balanced to realize optimal machine utilization. The honey-bee algorithm [10] balances the load within the VM and it also improves the quantity of waiting time of the tasks within the queue is minimal. There are numerous research papers that propose scheduling algorithms. a number of these proposed algorithms are particularly for serving jobs during a cloud computing environment and a few are created to suit the cloud environment. For the cloud environment, many adapted scheduling algorithms [4, 3] are proposed within the literature to reinforce the entire system performance. In this paper, we proposed a Load Balancing Extended Multi-objective Honey-Bee algorithm (LB-EMHB) to seek out the optimal resource allocation for every task within the dynamic cloud system. It minimizes the makespan, also adapts to the dynamic cloud computer system, and balance the whole system load. Then, this new scheduling strategy was simulated using the CloudSim version 3.1 toolkit package.

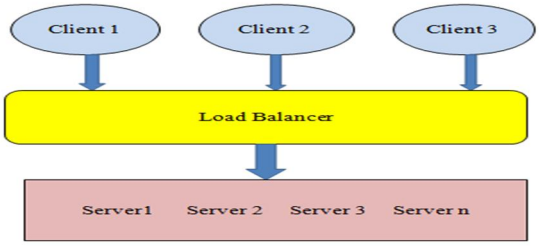

Figure 1.1 Load Balancer using Honey Bee Algorithm

In this paper, we proposed a Load Balancing Extended Multi-objective Honey-Bee algorithm (LB-EMHB) to seek out the optimal resource allocation for every task within the dynamic cloud system. It minimizes the makespan, also adapts to the dynamic cloud computer system, and balance the whole system load. Then, this new scheduling strategy was simulated using the CloudSim version 3.1 toolkit package. Experiment results showed the proposed LB-EMHB algorithm satisfies expectations. The experiment considers:

1) First Come First Served (FCFS)
2) Honey-Bee Algorithm (HBA)
3) Load Balancing Extended Multi-Objective Honey-Bee (LBACO)

The rest is organized as follows. Section II, we discuss the background and related work of VM scheduling. Section III introduces the essential Honey-Bee algorithm. Section IV details the proposed LB-EMHB algorithm. Section V the flow of the proposed working model. Finally, Section VI concludes the paperwork.

II. RELATED WORK

V.Priya et al. proposed a technique to introduce a combined resource scheduling (RS) and load balancing (LB) algorithm for efficient cloud service provisioning. The methodology used is the Fuzzy-based Multidimensional Resource Scheduling (FBMRS) model to improve the efficiency in cloud infrastructure. The utilization of Virtual Machines is increased through effective and fair load balancing is then achieved dynamically using the Multidimensional Queuing Load Optimization algorithm (MQLA). A load-balancing algorithm is then introduced to prevent under-utilization and over-use of services, thus optimizing makespan for each requested class. This is managed to implement the efficiency using Cloudsim in the cloud database and results show that the proposed method achieves performance in terms of Multi-objective factors. The study shows that the implementation improves the efficiency in (RS) efficiency by 8% and also reduces the reaction time by 35.5% as compared.

Dan Liuet. et al. proposed how which could separately provide on-demand, dynamic composite services, and reliable resource supply for users and cloud services. The paper has proposed a reliable service-resource combination mechanism to boost the service capability and realize the dynamic of the spot. The paper has designed a Quality of Service based resource node classifier to classify the resource attributes of CSS. When this happens service exception or user requirement changing the framework takes adaptive adjustment by RSR_AM and ensures cloud service supply by using Quality of Service Classifier to dynamically select high quality of service resource nodes. After comparing with Random and First Fit, Cloud_RRSSF can effectively reduce CDC's energy consumption while providing users with reliable services. The Methodologies employed during this project are QoS-based resource node classifier and Hybrid multi-object differential evolution algorithm.

Kwang Mong Sim et al. proposed a method to allocate reliable resources. During this project, and Intercloud is an interconnected global "cloud of clouds" that requests resources from one cloud to another, interactions among Intercloud stakeholders are complex because Intercloud resources are allocated and managed by different clouds. An agent is often an automatic processing system that's capable of constructing decisions independently and interacting with other agents through cooperation, coordination, and negotiation. Using an agent-based approach, characteristics related to intelligent behaviors of agents like interacting socially through cooperation, coordination, and negotiation are visiting be built into clouds. This discusses the advantages of using an agent model for Intercloud resource allocation; reviews representative models of agent-based Intercloud resource allocation, and provides a differentiation among these models and it also compares agent-based and non-agent-based approaches for task executions in multiple clouds. The constraints are it takes longer intervals while allocating the resources to the required nodes and also maintaining is complicated in intercloud resource scheduling.

Lan Wang et al. Proposed work on the QoS requirements of such a large number of different applications in these virtual cloud environments which have become an actual challenge, especially since the requirements and work pressure of the implementations vary widely and can vary over time. The fixed arrival rate scheme, with full information on arrival rates and repair rates, outperformed both the Recurrent Neural Network and the "sensible" approach thanks to the very fact that it employs the answer of an analytical model to minimize task latency under known mathematical assumptions. However such assumptions won't usually be known or valid in practice. Thus it's useful as a benchmark but can't be recommended in practical situations. These are a measurement-driven algorithm that uses reinforcement learning and a "sensible" allocation algorithm that assigns tasks to sub-systems that are observed to supply a lower latency, then an algorithm that splits the task arrival stream into many sub-streams. All of those schemes are compared via measurements among themselves and with a straightforward round-robin scheduler. The limitation is longer while allocating resources in multi-task allocation.

Guisheng Fan et al. proposed a significant new challenges to resource management, and efficient resource scheduling schemes are

highly demanded. QoS factors (reliability, efficiency, time) are proposed to address resource scheduling in the cloud. The reliability, efficiency, and time are taken into consideration in the process, thus allowing the precise characterization of user requests. First, we propose an adaptive resource scheduling strategy, thus reducing the number of invoked virtual machines of each job. Second, the reflection mechanism is used to construct the resource scheduling model of cloud computing, the model considers the adaptive recovery of job, the basic relationships between jobs, and the dynamic deadline of job, etc. Third, CTL (Computation Tree Logic) is used to describe the properties of the resource scheduling model, an adaptive resource scheduling algorithm is proposed to make user requests dynamically re-optimize and re-distribute resources at runtime.

Shamsollah Ghanbaria et al. proposed cloud computing intends to share oversized scale resources and equipment of computation, storage, information, and knowledge for scientific researches. Some intensive researches are tired of the world of job scheduling of cloud computing. During this paper, we've proposed a brand new priority-based job scheduling algorithm (PJSC) in cloud computing. The proposed algorithm relies on multiple criteria for higher cognitive process models. It mainly focuses on the priority of each job. However, we don't expect this algorithm has an optimal finish time. It means the algorithm must consider the priority of jobs rather than considering the finish time. Priority is a crucial issue of job scheduling in cloud environments. During this paper, we've proposed a priority based job scheduling algorithm “PJSC” which might be applied in cloud environments

Songtao Guo et al. cloud computing is an emerging and potential computing model, can significantly enhance computation ability and save energy for smart mobile devices (SMDs). Still, to achieve energy-efficient computation offloading under hard constraint for application completion time, there remains a challenge to cope with such a challenge. An energy-efficient dynamic offloading and resource scheduling (eDors) policy to split back energy consumption and shorten application completion time. While it satisfies task-dependence requirement and completion time deadline constraint. A distributed eDors algorithm has been proposed that consist of sub algorithms. Whereas, computation offloading selection depends not only on the computing workload of a task but also on the transmission energy power of the mobile device. Eventually experimental land up during a true testbed and to demonstrate that the eDors algorithm can promptly reduce EEC by adjusting SMDs clock frequency of CPU in local computing, and adapting the transmission power for wireless channel conditions in cloud computing.

Rajkumar Buvya et al. proposed significant advances in Information and Technology (IT) over the second half-century. The computing utility, like other existing utilities, will provide the essential level of computing service that considered being essential to fulfill the everyday needs of the final community. Also, perception of market-based resource management strategies that enclose both customer-driven service management and computational risk management to sustain Service Level Agreement (SLA)-oriented resource allocation are provided. Additionally, the difference between High Performance on Computing (HPC) workload and Internet-based services workload added is the two methodologies added to explain a meta-negotiation infrastructure to ascertain global Cloud exchanges and markets.

The Overall limitation studied from the review is, that it does not balance the QoS requirements and overall performance is slow. Minimum resource utilization and maximum processing time are the main concern in the cloud infrastructure. The reliability, performance, and the high energy consumption is the key problem that needs to be solved and it takes more response time while allocating the resources to the required nodes in multi-task allocation.

III. INTRODUCES THE BASIC HONEY-BEE ALGORITHM

Honey-bees in hive need flowers to get nectar. An appropriate division of the worker force between exploring the sphere for brand new rich sources and exploiting the known sources is clearly important for the upkeep of the colony. Food source communication: the waggle dance, it's been known for a protracted time that foraging honeybees provide information about food source through there waggle dance and that place is visited by other bees in the hive.

The goal of this is to add the rules, followed by each individual bee, which is necessary and sufficient to explain the collective foraging behavior. These rules include:

A. The traveling of an outgoing bee from the nest to the source
B. Searching for the source by a bee
C. The collecting of nectar from a source
D. Traveling back to the nest
E. The way in which information about the source is transmitted to other bees in the nest.

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IV. THE PROPOSED LB-EMHB ALGORITHM

The objective of this paper is to style an adaptive adjustment structure to allocate reliable resources to the cloud user in the cloud service system (CSS). The important issue to be solved is the high energy consumption and reliability. Most of the prevailing research work only take one aspect and neglects their interconnections. The proposed LB-EMHB algorithm tends to balance a load of VMs during task allocation by checking the variation of every VM time interval from the average time interval of all VMs. Once the worth of a specific VM becomes over or adequate a predefined threshold, it means this VM becomes overloaded at this point. The extended multi-objective is entirely influenced by the honey bees' natural foraging behavior. The allocated task updates the remaining tasks about the VM status during a manner almost like the bees finding an abundant food source, updating the opposite bees within the beehive through its waggle dance. This role updates the VM availability status and hence the loading of the VMs

A. LB-EMHB Algorithm Metrics

The aim of the proposed LB-EMHB is to allocate workload in a way that avoids under-utilization and over-utilization of the resources. It assigns the incoming task to a VM which meets conditions; tasks currently performed by this VM are less than the number of tasks currently performed by other VMs and the deviation of all VMs from that average processing time is less than the predefined threshold value. The notations used in the LB-EMHB are shown in Table 1.

Table 1. List of notations

Symbol	Definition
PT_H	processing time of host
PT_V	processing time of VM
TL_H	Total length of tasks submitted to hosts
TL_V	Total length of tasks submitted to VM
NP_H	Number of processors in host
NP_V	Number of processors in VM
SP_H	Processor speed of host
SP_V	Processor speed of VM
APT_H	Average processing time of all hosts
APT_V	Average processing time of all VMs
RL	Request Length

Cloud computing consists of a group of knowledge centers, each data center consists of a group of n hosts, each host consists of a group of m VMs. Each data center contains VM load balancer which answerable for finding an appropriate host and an appropriate VM during a chosen host to allocate the following task by finding some metrics. These metrics are calculated in line with Equations.

1) *The processing time of host:*

$$PT\_H(i) = \frac{TL\_H(i)}{NP\_H(i) \times SP\_H(i)} = \frac{\sum_{k=1}^{x1} RL(k)}{NP\_H(i) \times SP\_H(i)}$$

2) *The average Processing Time of all hosts:*

$$APT\_H = \frac{1}{n}\sum_{i=1}^{n} PT\_H(i)$$

3) *The processing time of VM (j):*

$$PT\_V(j) = \frac{TL\_V(j)}{NP\_V(j) \times SP\_V(J)} = \frac{\sum_{k=1}^{X2} RL(k)}{NP\_V(j) \times SP\_V(j)}$$

4) *The average Processing time of all VMs:*

$$APT\_V = \frac{1}{m}\sum_{j=1}^{m} PT\_V(j)$$

5) *Standard deviation of Load:* Standard deviation (σ) in statistics and probability theory shows how much variance or dispersion from the average occurs, which is defined as follows:

$$\sigma = \sqrt{\frac{1}{m}\sum_{j=0}^{m}(PT\_V(j) - APT\_V)^2}$$

6) *The standard normal deviate of VM (j):* In statistics, a deviation is a measure of the difference between the observed value and the mean. The sign of deviation (+) or (-), reports the direction of that difference Rules are, it is larger when the sign is positive, and smaller if it is negative). The distance division of one data point from its mean to the standard distribution deviation is known as the standard deviation of standardized value. The standard normal deviation is a unit deviation with zero mean, and it shows the variation from the average mean or the expected value.

$$SND\_V(j) = \frac{(PT\_V(j) - APT\_V)}{\sigma}$$

7) *The availability of VM (j):* VM availability is decided when the VM processing time variation of all VMs from the average running time is (equal) = or less (-) than the threshold value.

V. THE FLOW OF PROPOSED WORKING MODEL

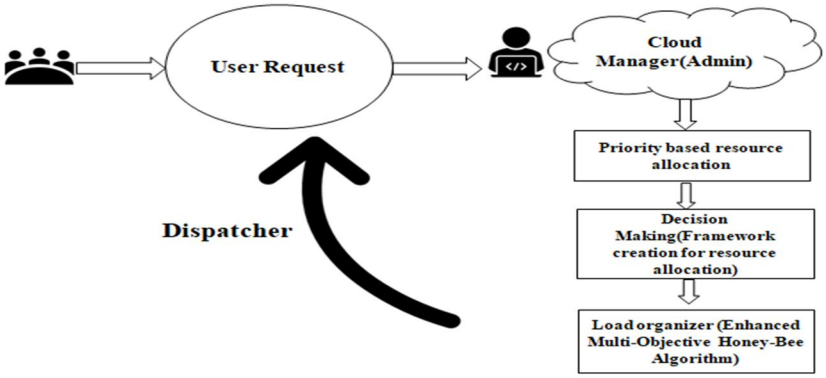

Figure 5.1 The flow of proposed working model

A. *Prioritize the task*

Based on scheduling Algorithm is meant to be used by organizations that need to implement small to medium-sized local clouds. This algorithm should scale to larger-sized clouds because one amongst the most contributions of the cluster controller is load balancing compute nodes. Each process is assigned as a priority. The process with high priority is to be implemented first so on. Processes with equal priority are executed on a first come first serve basis. Priority is often decided supported memory, time or the other resource requirement

B. *Adaptive adjustment module*

Multiple sub-services are aggregated to make a composite service that meets the requirements of the service target. QoS-based resource node classifier is to classify the resource attributes. A hybrid multi-objective differential evolution algorithm is employed for framework creation to achieve reliability, energy consumption in resource provisioning. It is aimed to dynamically obtain the changes of need and exception information when the user needs change when the abnormal service situation occurs, it can realize the dynamic adaptation of cloud service and dynamically select the resource node with top quality through QoS_Classifier to make sure the traditional provision of cloud services. The aspects are planned with the ultimate aim of getting the most amazing size having the most amazing rank. The Virtual Machines also are ranked (organized) consistent with their MIPS value with the top goal that the one having most noteworthy MIPS has the foremost noteworthy rank.

C. *Resource Allocation*

The principle of the proposed threshold-based technique is to efficiently allocate the cloud computing resources where users change their resource requirements dynamically supported time. During the allocation of resources to a cloud service or cloud application, scheduling algorithms should be applied on both levels (data center level and host server level).

At the info center level, an appropriate data center is chosen where the host server having enough resources to satisfy the dynamic requirement of application with reference to time exists. Whereas, at the host server level resource allocation to the appliance being scheduled, is taken under consideration. The primary concept is said to the choice of a knowledge center that's having a number of the host servers with free resources to assign to the new cloud application or cloud service. The second concept is to use the edge-based comparison of the knowledge center limit and host server limit.

Algorithm 2: VM Scheduling ()

1) *Input:* Set of tasks, vmList
2) *Output:* migrationList

a) vmList.sortDecreasingUtilization( )
b) foreach VMList do
c) VM1=Low, VM2= Medium, VM3= High
d) T□ Threshold
e) If(T <= SND_V)
f) Get storage details from all VM
g) For each vm in vmList do
h) then
i) Begin,(Based on the Availability migration will take place)
j) if VM1 is less
k) Add(VM1 + VM2)
l) Else if
m) Add(VM2 + VM3)
n) Else
o) Add(VM1 + VM3)
p) migrationList.add
q) Return

The cloud computing environment is established using the CloudSim simulator to implement this system.

D. Load Organization based on Extended Honey-Bee Algorithm

Load balancing done by using honey bee approach for the allocated task updates the remaining to scheduler about the VM status in a manner similar to the bees update about food source to other bees in the beehive through its waggle dance. The calculations are done using the metrics on the LB-EMHB algorithm based on setting the load for the virtual machine are more than the threshold value. In this case, tasks are not submitted to the overloaded machine, whereas the tasks are sent to underloaded virtual machines by the random search method.

The LB-EMHB algorithm for load balancing in the cloud was proposed in this approach eliminates the tasks from over-loaded VMs and assigns it to the most suitable under-loaded VMs. The task priorities in VMs queues are used in this approach; it selects the task with the least priority for migration in order to reduce the imbalance. A job is done through honey bee and therefore the under-loaded VMs are considered because of the destination of the honey bees. The information that bees update is the load on all VMs, the number of jobs in each VM, and the number of VMs in each set. Once the roles switching process is over, the balanced VMs are included in the balanced VM set. This aims to balance load across VMs and minimize the makespan in the cloud environment.

VI. RESULTS AND DISCUSSION

We have simulated a datacenter in our paper using CloudSim, with two hosts each with two PEs. We created three VMs that each requires one PE. Such VMs are classified as hosts depending on the No. of PEs in the host, and no. of PEs provided by VM.VMs were given the first two positions based on First Come First Serve basis.

Cloudlet ID	STATUS	Data center ID	VM ID	VM type	Time	Start Time	Finish Time
0	SUCCESS	2	2	low	11.14	0.1	11.24
1	SUCCESS	2	2	low	21.72	11.24	32.96
2	SUCCESS	2	2	low	32.23	32.96	65.2
6	SUCCESS	2	1	medium	72.38	0.1	72.48
3	SUCCESS	2	2	low	42.14	65.2	107.34
7	SUCCESS	2	1	medium	82.51	72.48	154.99
4	SUCCESS	2	2	low	51.58	107.34	158.91
19	SUCCESS	2	0	high	202.91	0.1	203.01
5	SUCCESS	2	2	low	61.13	158.91	220.05
8	SUCCESS	2	1	medium	91.61	154.99	246.6
9	SUCCESS	2	1	medium	101.75	246.6	348.36
20	SUCCESS	2	0	high	212.41	203.01	415.42

Figure 6.1 shows the execution status of jobs running in 3 VMs with different MIPS.

The average resource utilization is better in LB-EMHB as compare to the ant-colony load balancing algorithm; the result is shown in figure 6.2.

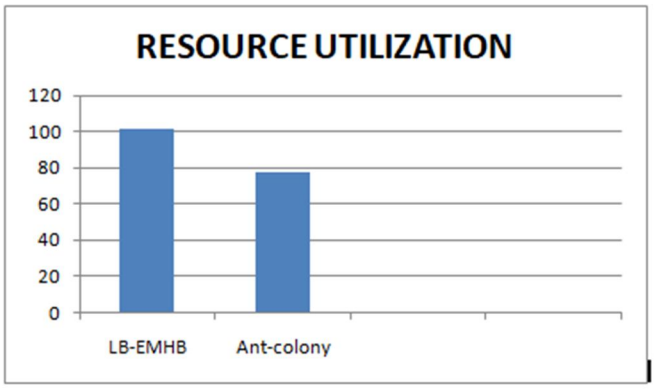

Figure 6.2 Result if average resource utilization when compared to other algorithm.

After implementing these two algorithms of load balancing we concluded that the LB-EMHB algorithms are better than the other load balancing algorithms. It was always said that a dynamic load balancing algorithm is better than the static load balancing algorithm.

VII. CONCLUSION

The cloud administrator allocated the requests dynamically. In real-time, there are multiple requests sent and it is challenging to fulfill all the requests at the same time efficiently. Hence, the scheduling process is done by honey bee based upon the user requests for services by using priority scheduling algorithm. While the resources are being allocated, the adjustment structure can dynamically aggregate the services. The services will split into several sub-services and allocation is done accordingly. The user with specific utility services and low energy usage is provided. CloudSim simulation software is used to incorporate the requirement based allocation of resources and load balancing.

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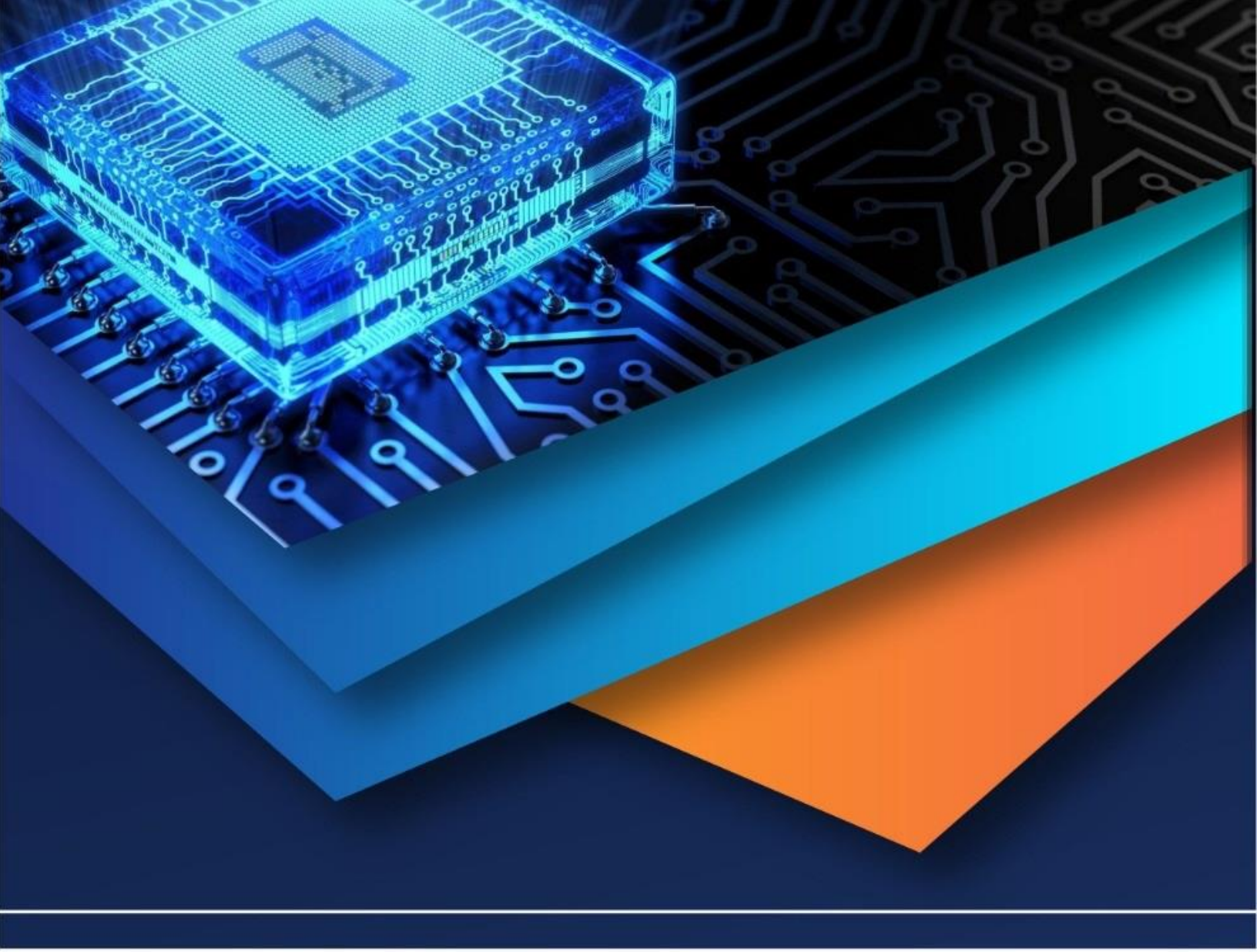

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