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Deployment of Private Cloud in Campus Wide Network

Kunj Marken[1], Dr. Lokesh Jain[2]
[1, 2]*Department of Electrical Engineering and Information Technology, PAU, Ludhiana, India*

Abstract: ***Cloud computing in the last few years has emerged as a modern computing paradigm with its establishment. This is becoming quite popular due to the reduction in cost, scalability and improvements in the IT industry. Virtualization technology has great contribution in field of computing platform. Cloud computing allows you to use services and resources online. It is used to build and maintain the necessary infrastructure for computing resources. For deploying the cloud in an organization as a private, there are various open source platforms and OpenStack retained by the comparative study. The paper describes development of private cloud on OpenStack software by installing CentOS7 operating system for cloud deployment. Different services are installed such as web server, webmail server, FTP and SSH for communication between users within the private cloud. The results depict that hardware utilization of physical machine increases after deploying virtualization. In cloud without virtualization, hardware resources are not used efficiently because of number of users is limited but in cloud with virtualization hardware resources are utilized at maximum and used by more concurrent users. The aim of paper is to present the importance of virtualization and give the best solution for providing services in private organization.***
Keywords: IaaS, Private cloud, Cloud computing, OpenStack, Virtualization

I. INTRODUCTION

Cloud computing is an IT service which is distributed and operated through the IT resources and software guided by it. Virtualized resources offered cloud service for information exchange over the Internet. The user accepts that technology and infrastructure which is called cloud. Cloud computing is internet based computing where virtually many shared servers and software provide infrastructure, platforms, variety of tools and other resources so that customers can provide hosting based on the pay-for-use. In cloud computing model, cloud is served by its software as a service through a digital system like all of the exchange of data. Developers use various services available on internet cloud in many ways [1].

Different types of clouds that can be implemented such as private cloud, public cloud, community cloud and hybrid cloud. Public cloud computing shared services to users and multiple organizations which includes shared data resources infrastructure. Common public cloud vendor services are Microsoft Azure, IBM and Web Services. In Private cloud, services and infrastructure own by only one organization. Hence it is located faraway, expensive, and secure and has physical control over infrastructure. Common private cloud vendor services are VMware, Open Stack. Community cloud services provide shared data and infrastructure to the organizations and to the mediator provider. It can be hosted privately and publicly. Hybrid cloud is combination of three types of cloud services (private, public, community) from different service providers. Hybrid development model is method to combined infrastructure and application between cloud computing resources [2].

Various cloud services that are available to the clients like Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). These services are also known as SPI model. In IaaS model virtual resources (storage, server and network) are provided to the tenants. They provide resources according to requirement and charge as per the usage. In this clients don't have control on infrastructure resources but it has control on operating system, data and applications. In this data remains secure. It is useful for small and average industry. IaaS service providers are Microsoft Azure, Google Compute Engine, Rackspace Open Cloud and Amazon Web Services etc [3]. PaaS is a cloud computing services that allows customer to create and maintain application in cloud environment without having any problem of maintaining infrastructure. In this, the tenant provides network, services, storage and operating system, the customer only has to develop the application using these framework. PaaS service providers are Google App Engine, Amazon AWS, Windows Azure and Engine Yard etc. In SaaS cloud services, the customers need not to install or run applications on system. Customers only have to use web browser to access any services. SaaS provides applications to the customers on rental basis to interact with resources (hardware, software and operating system). SaaS provides almost free services; customer uses these services via internet. SaaS service providers are Salesforce.com, Microsoft Dynamics etc [4].

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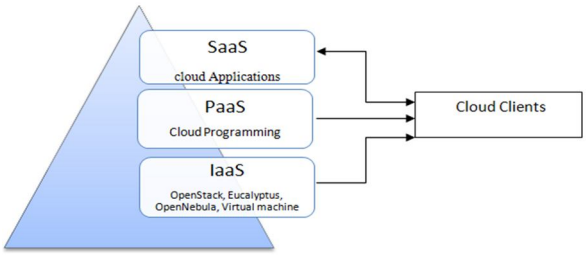

Fig. 1 General architecture of cloud.

Figure 1 represents three different levels of cloud [5]. Third level represents hardware resources and virtualization. Second level provides the platform for communication between the hardware and the application and first level is user friendly level that allows interactions between users and cloud platform.

The development and use of open source in this field has seen a significant increase in last few years mainly in web based software and applications. As per the research done on this, open source had not been used deeply for the composition and management of cloud computing and its platform. The approach to open source cloud is that there are many types of software and media on open source that allow you to create cloud and include incremental improvements. The open source cloud continues to grow in the services that provide extensive changes which are the useful in nowadays technologies. Today all are free to adopt the same old data storage system in a new way, looking at many of the open source software that allows completely new patterns to power a digital world for this technology [6].

Rest of the paper is classified as follows, Section I describes the introduction of cloud computing, types of cloud, different cloud services and brief introduction about open source software's Section II contain comparative study of different open source clouds, Section III explains OpenStack introduction and its components along with diagram and steps to launch an instance in OpenStack, Section IV explain results and discussion about impact in hardware with and without virtualization, Section V summarize research work with future scope.

II. DIFFERENT OPEN SOURCE PLATFORMS

There are various open source platforms for the implementation of open source clouds. They are Eucalyptus, CloudStack, OpenNebula and OpenStack. Open source software offers its infrastructure in the form of a service to deliver the best virtualization environment for deployment.

1) *Opennebula:* Open Nebula was first established in 2005, under a research project, by Ignasio M. Litor and Reuben S. Montero, which is used by many enterprises for their virtual machine (VMware) data center on virtual cloud There was a research done as an open and flexible option. Open Nebula is basically the tool for virtualization to control virtual infrastructure platform which is called as private cloud as well as with the addition of public cloud-based infrastructures It supports Hybrid Cloud to combine local infrastructure, which is highly scalable. Sting environment is enabled and single. Open Nebula Cloud platform with expanded features allowed user to have scalable and fast services [7]. It also works with public cloud allowing platform to focus on practicality of virtual machines and its storage management.
2) *Eucalyptus:* The Elastic Utility for connecting the Eucalyptus program to a useful system is a short form for computing architecture. It is an open source software package platform for cloud computing that implements on Infrastructure as a Service. The network is configured by the component controller and each controller SSH key files are authenticated and allow permission to trusted transactions. Eucalyptus scalability is less and they don't show source code of some of its modules. This is why it is being discarded for other solutions [8].
3) *Cloud Stack:* Cloud Stack computing platform was originated by cloud.com, it was acquired by Citrix and later it absolutely was discharged within the Apache Incubator program. It is the primary version of Cloud Stack was released on 2013 and at this point it absolutely was ruled by Apache Software Foundation and supported by Citrix. Cloud Stack supports many others features i.e. freelance calculation of information storage, new security measures, sleek preparations, its extensibility, its multi hypervisor support, brief documentation and effective web user interface. The solid design of Cloud Stack that deploys some objections, one is less flexibility in its formulation.
4) *OpenStack:* OpenStack software package is recent and still developing. Its potential owing its design, community and conjointly guide its partners. OpenStack is a cloud infrastructure originated by NASA devoted to high level platforms.

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5) Major OpenStack Characteristics are

a) Scalable: This resolution is already configured worldwide in firms whose data storage is calculated in petabytes of shared architectures and highly extensible to one million physical machines, up to 60 million virtual machines and billions of hold on objects [9].

b) Compatible and Flexible: OpenStack allows many virtualization result of the market: ESX, KVM, Xen, LXC, QEMU, Hyper-V, UML and XenServer [9].

c) Open: It an open source technology, its program code can be easily changed and modified as per the need. This OpenStack project also presents the authentication method for creation and deployment of latest standards [9].

III. MATERIALS AND METHODS

OpenStack is an open source cloud which provides various tools for creating and deploying various clouds and this software is released under provision of Apache license. This software provides features for end user where they run its self services on reliable and scalable servers. OpenStack provides facilities for deploying instances that manage multiple operations for controlling cloud environment. It allows massive scaling, infinite capacity and self service.

A. Hardware and Software Utilized

1) Core i5 processor with VT support
2) 40 GB hard disk Space
3) Internal storage- 500 GB
4) RAM - 16 GB
5) Virtualization support
6) Operating System –Centos7 server
7) Hypervisor- KVM
8) Centos 7 with linux kernel version 3.10.0

Architecture of OpenStack is combination of various components. Figure 2 represents the basic architecture of OpenStack and functionalities of different components [10].

B. Various Components Are

1) Nova: This compute services consisting of compute nodes which handle different virtual machines and other instances to control their tasks. Controllers that manages scheduling and API calls.

2) Swift: It is an object and files storage system. The files along with the objects are written on many disk drives spread across with mirroring the entire data. OpenStack is responsible for replicating information and ensuring its integrity throughout the cluster[10].

3) Cinder: It is volume service, which provides block level storage and storage for virtual machines. Through disk drive it provide to access location. OpenStack is an instrument for computing with its example. Volume service manages the launching servers, its attachment, and coaching.

4) Neutron: It provides network capabilities for OpenStack, which makes OpenStack more easily, quickly and efficiently, a unique system for management of network and IP addresses.

5) Horizon: This is backbone in OpenStack architecture which allows basic administrator functions and it provides user interface facilities to use cloud-based resources, and its provision and automation.

6) Keystone: It is identity service which allows authentic services in OpenStack such as ID, IP-password etc. This service is used to manage several access and integrated with some backend services [10].

7) Glance: It allows image services, Registration and Distribution services. This service also manages and retrieves disk images. OpenStack allows image with extensions qwco2, raw, iso, vmdk and ami.

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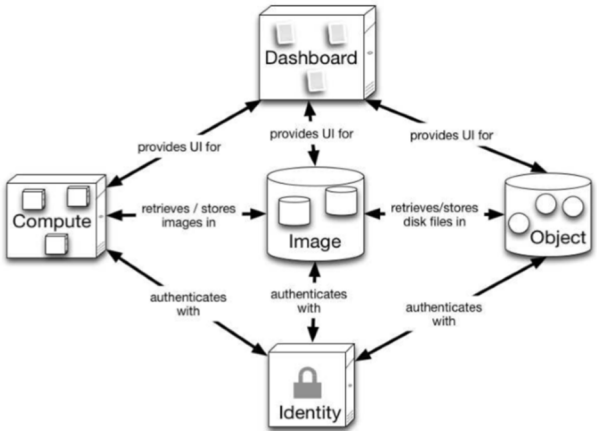

Fig. 2 Architecture of OpenStack.

Observed that the use of different types of policies is still a challenge in many areas and the clouds can benefit from it. In order to know how to use Open Stack services to create web applications in various ways on the existing Open Stack application Cloud. OpenStack allows developing virtual private server called instance with Centos7 qwo2 image file. Also establishes private and public network and proper connection, flavors, load balancer, router, key pair and security group for instances.

C. Steps of Launching an Instance in OpenStack: -

1) Login to OpenStack dashboard
2) Create virtual networks i.e. private and public, router and bridge connections.
3) Download and install image of particular operating system
4) Generate key pair
5) Add customized security group rules
6) Launch instance
7) Select name , image and specify volume for instance
8) Select desired flavor for instance
9) Select private network for creating private server
10) Select default and customized security group
11) Select particular key pair
12) At last, Select metadata

Hence, Instance is launched, check the status of instance and access the instance using virtual console and using SSH command from any host within private network. Installed and configured LAMP (Linux, apache, php, mariaDB) software on this instance. Also different services were installed and deployed on this instance. These services includes apache web server, webmail server configuration through rainloop application to send and receive mails between instance users, SSH configuration through Putty application, FTP configuration through filezilla application for upload and download file and webmin application to monitor instance.

IV. RESULTS AND DISCUSSIONS

Further performance measurement was carried out. In order to assess the performance of the cloud with and without virtualization few metrics was chosen such as CPU Utilization, Memory Utilization and Network Utilization. The results were extracted from the data collected from the tested experimental setup at different interval. The measurements were taken for average of five iterations so as to improve the obtained results accuracy. These experiments were conducted to test how cloud behaves when kept under various cases. These metrics were considered because they measured server performance efficiently; the usual suspects are CPU, Memory and Network. Centos 7 operating system was considered for this experiment. These experiments were divided into two stages. At both cases performance of the cloud working with virtualization and without virtualization was calculated. It has ensured that the hardware specifications are same in both cases.

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A. Case 1: CPU Utilization

In this case, increase the load on CPU to reach its peak to understand its behavior. Figure 3 represents graph without virtualization, in this initially the CPU utilization steadily increases with time when using different applications on machine and after some seconds it varies in its constant way. Figure 4 represents graph with virtualization, in this 60 seconds of the experiments are considered as warm-up phase and are eliminated from analysis. CPU utilization increases while initializing each VM. When there is increased load in each virtual machine then utilization on machine also increased. It is observed that average of CPU load average on cloud with virtualization is higher as compared to cloud without virtualization. This is because in figure 3 CPU is not utilized maximum and used by single user only with multiple applications but in figure 4 CPU usages is utilized maximum and used by four virtual machines or four users. So it can be concluded that CPU utilization on virtualized cloud is favorable than non virtualized cloud.

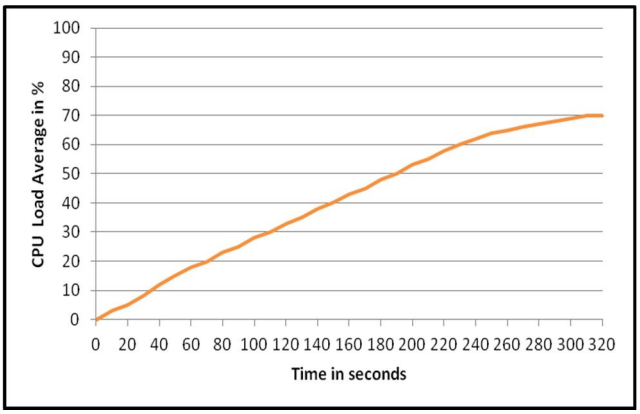

Fig. 3 CPU Utilization without Virtualization.

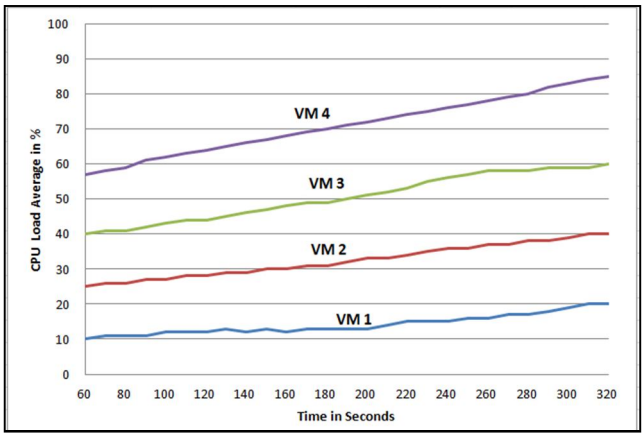

Fig. 4 CPU Utilization with Virtualization.

B. Case 2: Memory Utilization

In this case, managed the memory at high level and measured to check their behavior. Figure 5 represents graph without virtualization, in this initially the memory usage increases with time when using different applications on machine and after some seconds it varies in its constant way. Figure 6 represents graph with virtualization, in this 60 seconds of the experiments are considered as Warm-up phase and are eliminated from analysis. Memory usage increases while initializing each VM. When there is increase load in each virtual machine then utilization on machine increased. It is observed that memory usage on cloud with virtualization is higher as compared to cloud without virtualization. This is because in figure 5 memory is not utilized maximum and used by single user only with multiple applications. But in figure 6 memory usage is utilized maximum and used by four different virtual machines or by four users. So it can concluded that memory utilization on virtualized cloud is favorable than non virtualized cloud.

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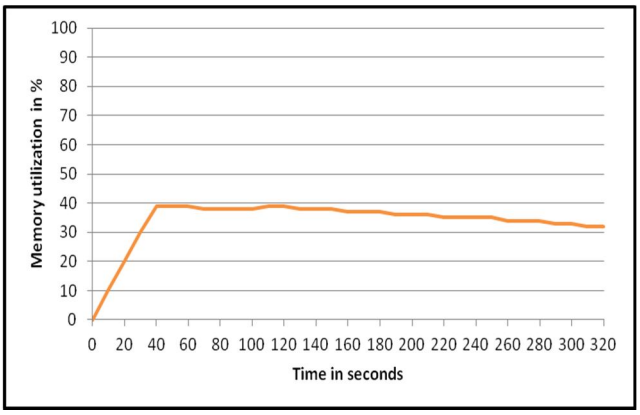

Fig. 5 RAM Utilization without Virtualization

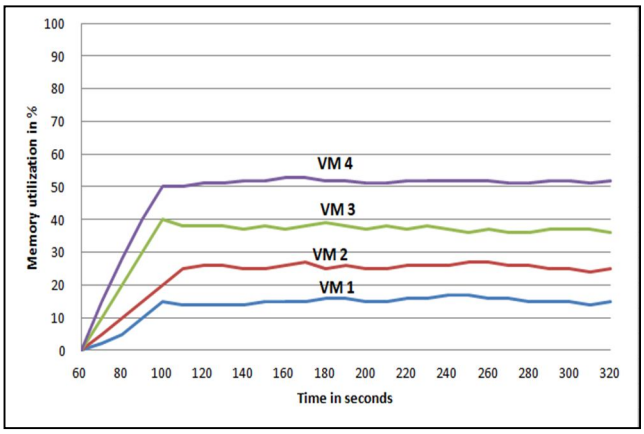

Fig. 6 CPU Utilization with Virtualization.

C. Case 3: Network Utilization

In this case, increase the load on network to check their behavior. Figure 7 represents graph without virtualization, in this initially the network usage increases with time when using different applications on machine and after some seconds it varies in its constant way. Figure 8 represents graph with virtualization, in this 60 seconds of the experiments are considered as warm-up phase and are eliminated from analysis. Network usage increases while initializing each VM. When there is increase load in each virtual machine then utilization on machine increased. It is observed that network

usage on cloud with virtualization is higher as compared to cloud without virtualization because in case of figure 7 network is not utilized maximum and used by single user only with multiple applications. But in figure 8 network usage is utilized maximum and used by four different virtual machines or by four users. So it can be concluded that network utilization on virtualized cloud is favorable than non virtualized cloud.

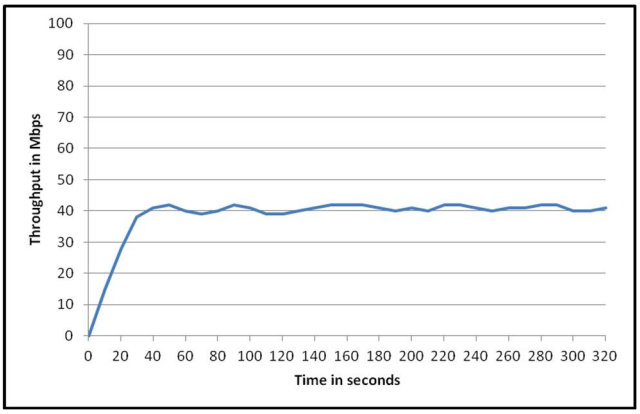

Fig. 7 Network Utilization without Virtualization

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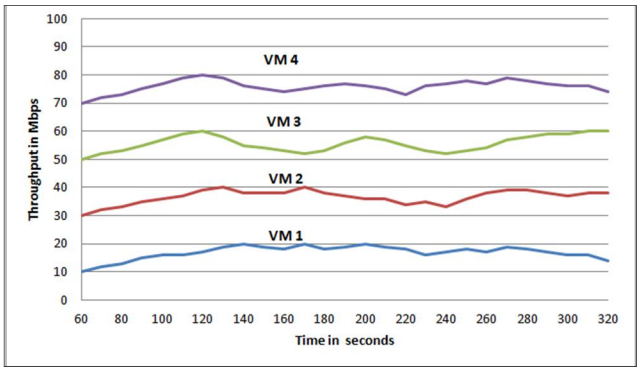

Fig 8 Network Utilization with Virtualization

In figure 3, 5 and 7 represents hardware utilization of the physical machine without virtualization. Hence variations in hardware (CPU, RAM and Memory) utilization increase. After virtualization concept in figure 4, 6 and 8 represents hardware utilization of the physical machine with virtualization. From all graphs we can easily conclude that cloud with virtualization performed much better as compared to cloud without Virtualization. There was considerably high difference in all the performance metrics. Remoteness, security and performance remain the main assets of using virtual private cloud.

The other concern about virtual private clouds is reducing the cost of hardware, decrease the data-center requirement and also reduce power utilization.

V. CONCLUSION

In this study described that deployment of a private cloud for organization providing services in form of infrastructure and providing operating system services in form of platform. OpenStack software is supposed to allow developers for deploying infrastructure and used different functions for installation and configuration of virtualization on existing resources. This study explained that the OpenStack cloud platform has achieved major importance in the designing area of computing platform by allowing simple ways to deploy cloud over existing resources. OpenStack allows developing virtual private server called instance and deployed that instance with multiple running services like LAMP, Webmail, Web hosting and FTP server. OpenStack cloud will be used in future works for evaluation performance in IaaS platform and deploy further more services for campus wide network.

VI. ACKNOWLEDGEMENT

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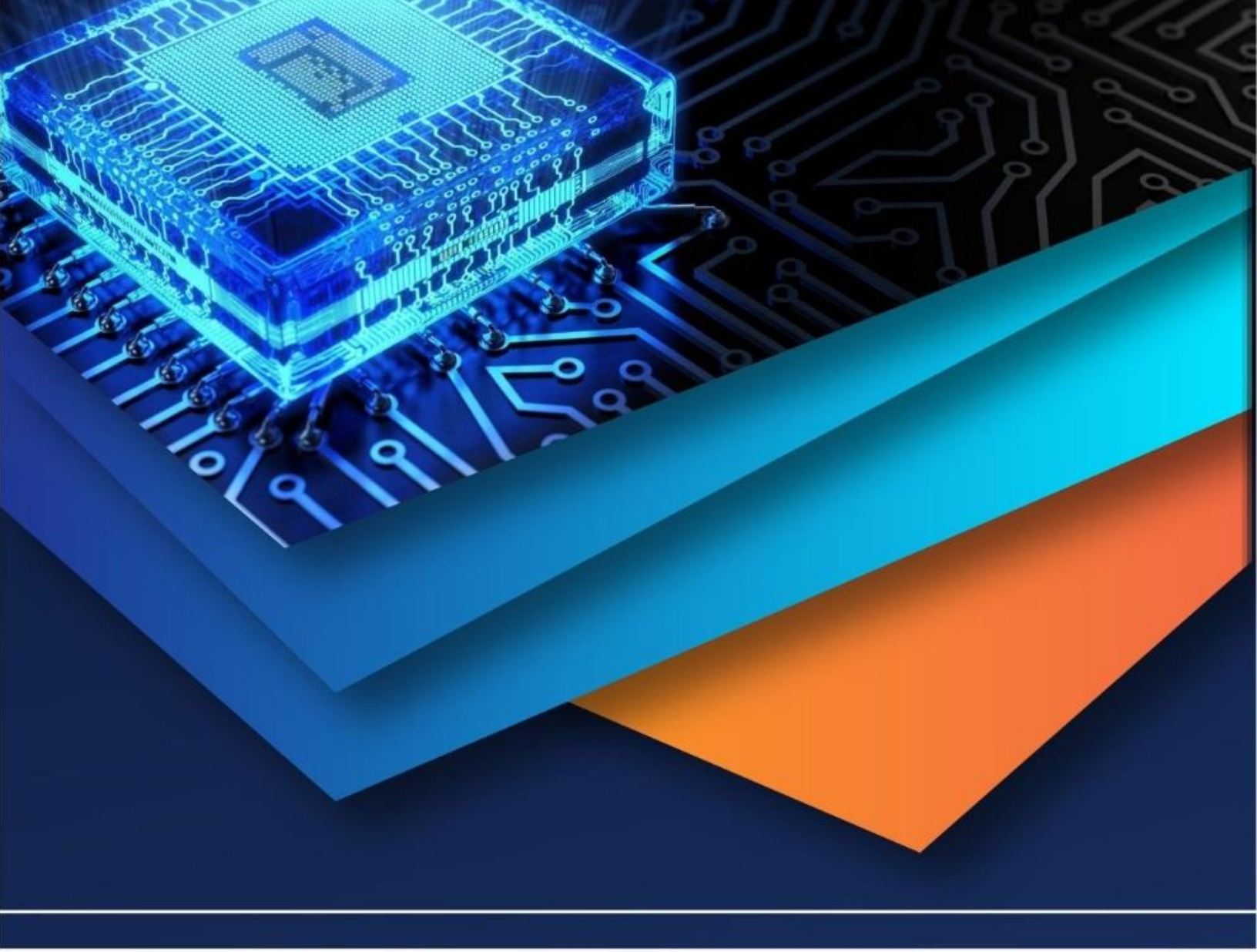

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