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An Application of Map Reduce for Domain Reducing in Cloud Computing

Umar Khalid Farooqui[1]
[1]Research Scholar MUIT, Department of Computer Science & Engineering MUIT

Abstract*: Clouds computing is tremendo usly growing technology which offers a different way to architect and remotely manage all computing resources; it is of sharing resources/information as-a –service using internet as carrier. It definesboth a platformand kind of application. A Cloud computing platform can dynamically provisions de-provision & configures, reconfigures servers as needed. Servers in the cloud can be physical machines or virtual machines. Cloud computing also describes applications that are extended to be accessible through the internet. This work is an attempt to propose an architecture which reduce huge data set into smaller one using map reduce. A huge data set could be list of documents, urls etc given by web services which has to be filtered based on user specific search criterion. Here jobs run in parallel environment and also schedule of jobs is automatic. It also uses a technique by which it will clean up the data and reduce the complexity.
Keywords*: Map Reduce, Storage, De-provisioning, Cluster Container.

I. INTRODUCTION

Cloud computing is the fastest growing service delivery model which offers multi-tenancy on metric basis and the user of cloud need to pay only for which he use ,it also remove the burden of expanding rigid infrastructure with the company growth. The customer of cloud believes in hiring IT resources from providers as per demand and release it as they finish the job, The cloud services sits upon virtualization and its interfaces are open to all.[14]

The cloud applications are extended to be accessible through the internet. It uses large data centers and powerful servers that host web application and web services. Any one with suitable internet connection and a standard web browser can access a cloud application [2].

A. A Cloud Can Be Viewed As A Pool Of Virtualized Computer Resources, It Can-

1) Host a variety of different workloads including batch style back end jobs and interactive user facing applications.
2) It allows jobs to set up and extend quickly through the fast provisioning of virtual machines or physical machines.
3) Support redundant self recovering, highly scalable programming models that allow workloads to recover from much unavoidable hardware/software failure.
4) Monitor resource use in real time to enable rebalancing of allocations when needed[2].

A cloud is more than a collection of computer resources because a cloud provides a mechanism to manage these resources, management includes provisioning, change request, workload rebalancing, de provisioning and monitoring.

Cloud computing infrastructures can allow enterprises to achieve more efficient use of their IT hardware and software investments. Cloud computing permits management of the group of system as a single entity.

The infrastructure can be a cost efficient model for delivering information services, reducing IT management complexity, promoting innovations and increasing responsiveness through real time workload balancing.

Applications that are composed utilizing cloud design keeps running in the cloud and the physical area of the framework is chosen by the supplier, They utilize straightforward APIs of web open administrations that reach out on request ,that are mechanical quality ,where the mind boggling dependability and adaptability rationale of the basic administration stays actualized and covered up inside the cloud.

.We would like to design an architecture that allows user to filter the “Million Search Result” and hence reducing the Huge Data Set into smaller one. The application runs in parallel environment while the jobs are scheduled automatically, we also provide a technique which will cleanup the data and reduce the complexity and hope that it will be more efficient and effective.

II. BACKGROUND

Cloud computing automate management of group of systems as a single entity, cloud computing also describes applications that are extended to be accessible through the internet .Greg Boss, Linda et.al. Proposed architecture that focuses on the core backend of the cloud computing platform it does not address the user interface [2].

A well known platform for deploying clouds and developing applications is Aneka, it provides a runtime environment and a set of API that allows developers to build .NET applications that perform their computation on either public or private clouds.

They propose a customizable and extensible service oriented run time environment represented by a collection of software container connected together [1]

Eucalyptus is an open source software framework for cloud computing that implements Infrastructure as a service (IaaS) system that gives user the ability to run and control entire virtual machine instances developed across a verity of physical resources. It is a portable modular and simple to use infrastructure common to academics [4].

The Google File System is a scalable distributed file system for large distributed data-intensive applications. It provides fault tolerance while running on inexpensive commodity hardware, and it delivers high aggregate performance to a large number of clients. While sharing a significant number of an indistinguishable objectives from past dispersed document frameworks, their plan was driven by perceptions of their application workloads and mechanical condition, both present and foreseen that mirror a stamped takeoff from some before record framework suspicions. They show document framework interface augmentations intended to help disseminated applications, talk about numerous parts of their outline, and report estimations from both miniaturized scale benchmarks and certifiable utilize. [5]

Map Reduce is a programming model and an associated implementation for processing and generating large data sets. Clients indicate a guide work that procedures a key/esteem combine to create an arrangement of middle of the road key/esteem sets, and a diminish work that consolidations every single halfway esteem related with a similar moderate key. Numerous Real world assignments are expressible in this model [6].

III.METHODOLOGY

Map Reduce is a software framework introduced by the google in 2004 to support distributed computing on large datasets on clusters of computers. The framework is inspired by Map and Reduce functions commonly found in functional programming.

Map Reduce libraries have been written in c++, c#, Erlang, java, perl, pythen, and other programming language.

Map reduce is not a data storage or management system, it is an algorithmic technique for the distributed processing of large amount of data (Google web crawler is a real life example).

Hadoop Map reduce is an open source appropriated preparing system that permits calculation of expansive datasets by part the datasets into reasonable pieces, spreading it over an armada of machines and dealing with the general procedure by propelling employments, process it and toward the end total the activity yield in to a last outcome .

A. It Works In Three Stages

1) Map Phase
2) Combine Phase
3) Reduce Phase

A map phase changes the contribution to a moderate portrayal of key esteem sets.

A combine phase joins and sorts by the keys. Furthermore, a decrease stage recombines the middle of the road portrayal into definite yield. Designer executes two interfaces Mapper and Reducer, while hadoop deals with all the disseminated preparing (programmed parallelization, work planning, work observing, and result collection).

In hadoop there is an ace procedure running on one hub to regulate a pool of slave forms (laborers) running on discrete hubs .Hadoop parts the contribution to lumps. These pieces are relegated to slaves, each slave play out the guide task(logic indicated by the client) on each match found in the lump and composes the outcome locally and advise the ace of the finished status .hadoop joins every one of the outcomes and sorts the outcomes by the keys the ace at that point allots keys to the reducers. The reducer pulls the outcome utilizing an iterator, runs the decrease undertaking (rationale determined by the client), and sends the last yield back to appropriated record framework

The Map and Reduce functions of Map Reduce are both defined with respect to data structured in (key, value) pairs. Map takes one pair of data with a type in one data domain, and returns a list of pairs in a different domain:

Map $(K_1, V_1) \rightarrow$ list (k_2, v_2)

The Map function is applied in parallel to every item in the input dataset. This produces a list of (K_2, V_2) pairs for each call. After that, the Map Reduce framework collects all pairs with the same key from all lists and groups them together, thus creating one group for each one of the different generated keys.

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The Reduce function is then applied in parallel to each group, which in turn produces a collection of values in the same domain:
Reduce (K_2, list (V_2)) → list (V_3)
Each Reduce call typically produces either one value v3 or an empty return, though one call is allowed to return more than one value. The returns of all calls are collected as the desired result list.
Thus the Map Reduce framework transforms a list of (key, value) pairs into a list of values. These behaviors is different from the typical functional programming map and reduce combination, which accepts a list of arbitrary values and returns one single value that combines all the values returned by map.
It is fundamental yet not adequate to have executions of the guide and diminish deliberations with a specific end goal to actualize Map Reduce. Circulated executions of Map Reduce require a methods for associating the procedures playing out the Map and Reduce stages. This might be a circulated record framework. Different alternatives are conceivable, for example, guide spilling from mappers to reducers, or for the mapping processors to serve up their outcomes to reducers that question them

IV. ALGORITHM

The web service which crawl massive data creates a super
set of URL‟s, the super set of URL‟s be represented as-
Super Set= {A, B, C, D…………Z},
Where each A, B...and so on, are it self a set of URL‟s, which can be represented as-
A= {a_1, a_2, a_3……….a_n},
B= {b_1, b_2, b_3….b_n}‟‟
.
.
Z= {z_1, z_2, z_3………z_n}.
Here each a_1, b_1… are individual URL.
The set of URL‟s are then passed to the proposed application as first input and the request pattern as second input, the I/O container will be responsible for maintaining a compressed file as input which keeps these sets (A to Z) in ordered fashion and hence create a list of sets and assign a unique "LocationPointer" to each set, Now each arbitrary set and its corresponding locationpointer is applied as (key, value) pair to a distributed map/reduce function The map function return these (key, value) pairs in a different domain.
Map (k_1 , v_1) ⟶ List (k_2 , v_2)
Map function is distributed and in parallel environment provisioned by Cluster Container, it produce various list of k_2 , v_2, these lists are then combined (intermediate result) and passes to reduce function, the reduce function finally aggregate these intermediate results and produce final result. Distributed map/reduce operation is pictorially represented in Fig 1.

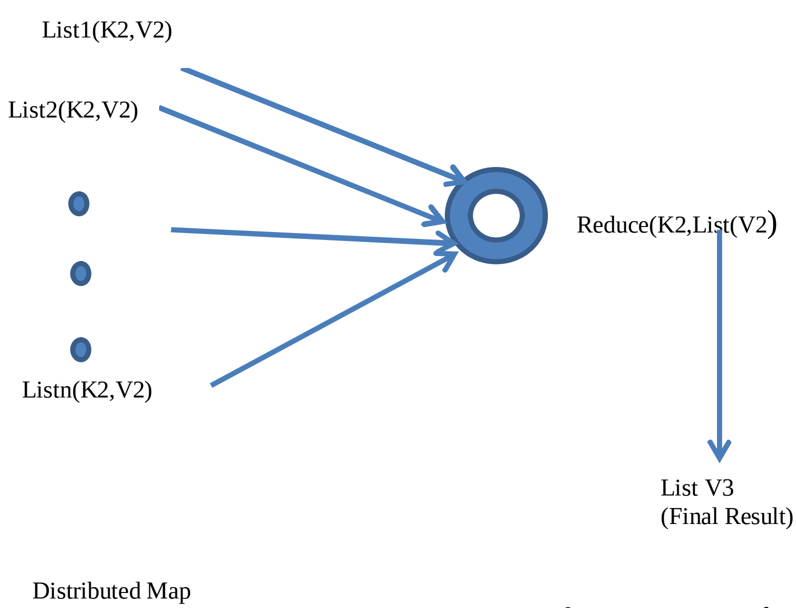

Fig 1: Pictorial Representation of Map/Reduce

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Pseudo-codes
Void Map (LocationPointer, URLSET);
//URLSET is a sub set of huge data set from I/O container
//LocationPointer serves the basis for key, it is provided by //I/O container
For each URL in URLSET EmitIntermidiate (“RequestPattern”, URL); Void Reduce (“RequestPattern”, URLSET)
For each “RequestPattern” in URLSET Append (URL, NEWURLSET); Emit (NEWURLSET);

V. PROPOSED APPROACH

The context diagram is shown in fig2. The web service that crawls web produce a huge data set (i.e. list of sorted document URLs), this huge data set is given as primary input to this application and another input is given by the user as „request patterns‟.

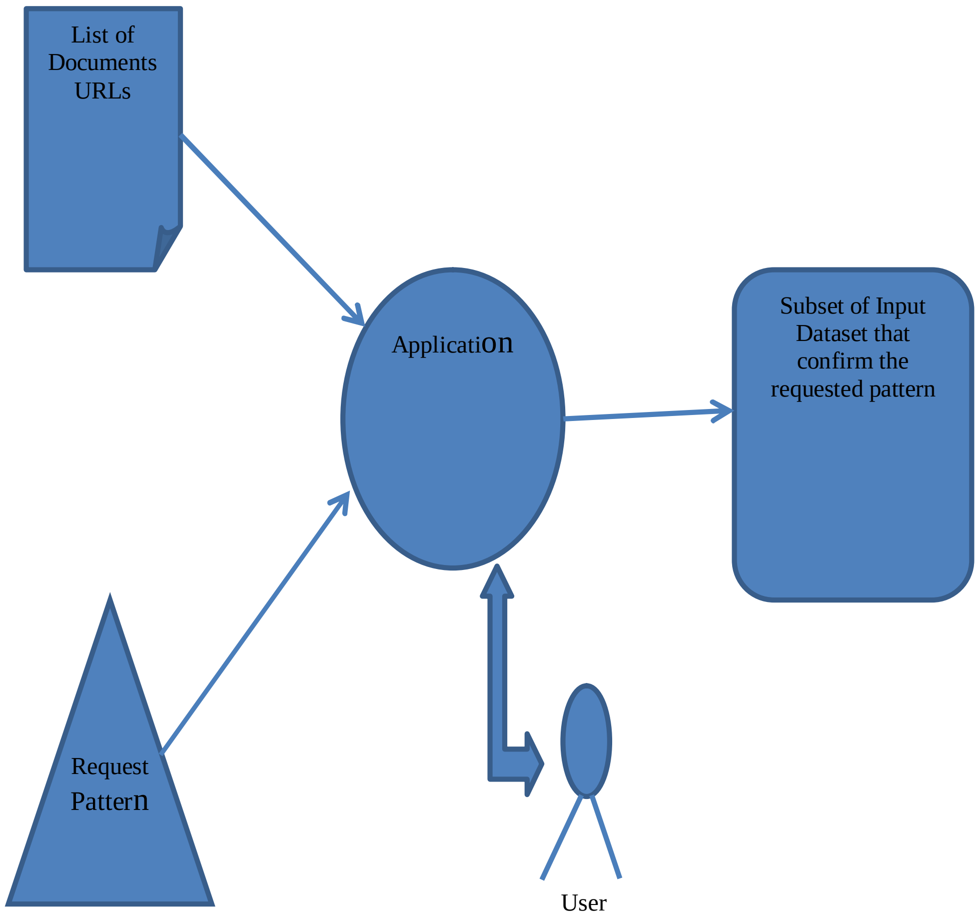

Fig 2: Context Diagram

It will then return a filtered sub set of document links as final output. Since the overall process is asynchronous, user can get the status of their job using getStatus( ). The approach is to build an application that scales with demand, while keeping the cost of upfront investment down and to get response in a reasonable amount of time. It is important to distribute the job in to multiple tasks and to perform a distributed search application that run those tasks on multiple nodes in parallel. The application is modular it does its processing in four phases as shown in fig 3. The initialization phase is responsible for validating and initiating the processing of a user request, starts all the job process initiating master and slave clusters. The service phase is responsible for monitoring the clusters, perform map reduce, and checking for success and failure. The de provisioning phase is responsible for billing and de provisioning all the processes and instances. The cleanup phase is responsible for deleting the transient data from the persistent storage. This application is modular and use following component I/O Container: For retrieving input data sets and for storing output data sets. Buffers: For durable buffering requests and to make the entire controller asynchronous.

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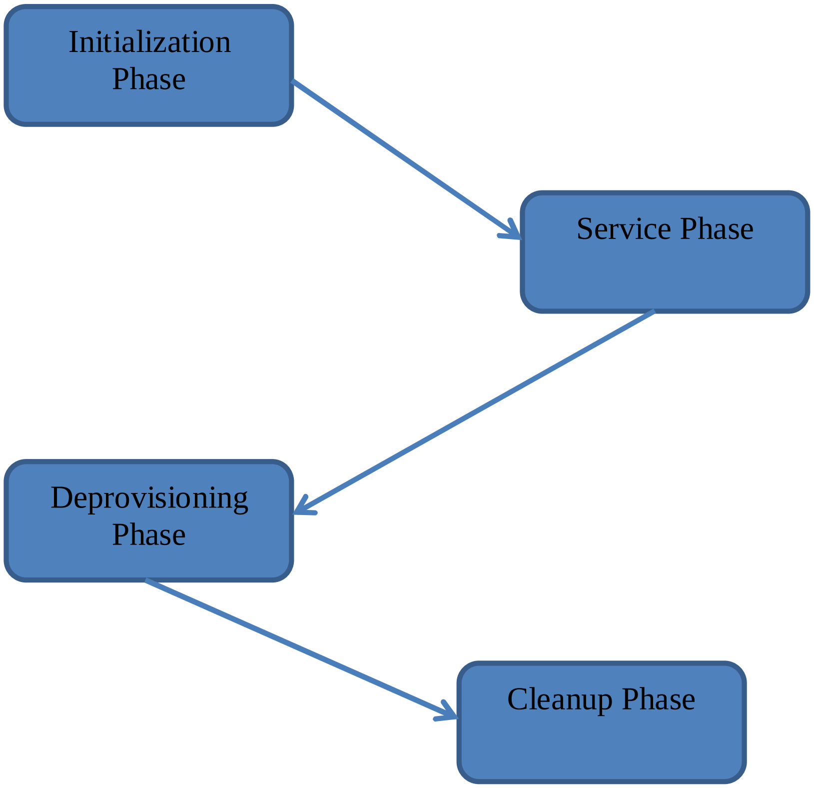

Fig 3: Phases of Application

Storage: For storing intermediate status, logs, and user data.
Cluster Container: For distributed processing, automatic parelellization and job scheduling.
The detailed work flow is shown in fig 4.
As application starts, buffers are created if not already created and all the controller threads are started. Each controller thread starts polling their respective buffer for any message.
When a start message is received an initialization message is post in the init buffer, the initialization controller thread pickup the initialization message and execute the task, update the status and timestamps in the persistent storage it also post a new message in the service buffer and deletes the message from the init buffer after processing.
The initialization task starts clusters and starts Map/Reduce task, it run map tasks on slave nodes in parallel. Each map task takes files (multithreaded in background) from I/O container and writes the match result along with a description of up to 5 matches locally and then the combine/reduce task combines and sorts the result and consolidates the output .The final result are stored on the I/O Container‟s output bucket.
The service controller thread pickup this message, validates the status/error in the persistent storage and execute the task updates the status in the database post a new message in the de provisioning buffer and billing buffer and deletes the message from service buffer after processing.
During service phase it checks for the cluster status (job tracker success/failure) in regular intervals, updates the persistence storage (database) items with status/error and output file in the I/O container The de provisioning controller thread pickup this message from the de provisioning buffer and executes the de provisioning task, updates the status and timestamps in persistent storage, deletes the message from the de provisioning buffer after processing, this kills the process, terminates the instances of clusters and finally disposes of the infrastructure.
The billing task gets information of usage calculates the billing and passes it to billing service.
The cleanup phase archive the persistent storage‟s (the database‟s) data with user info.
User can execute getStatus ( ) on the service endpoint to get the status of the overall system and download the filtered result from the I/O container after completion.

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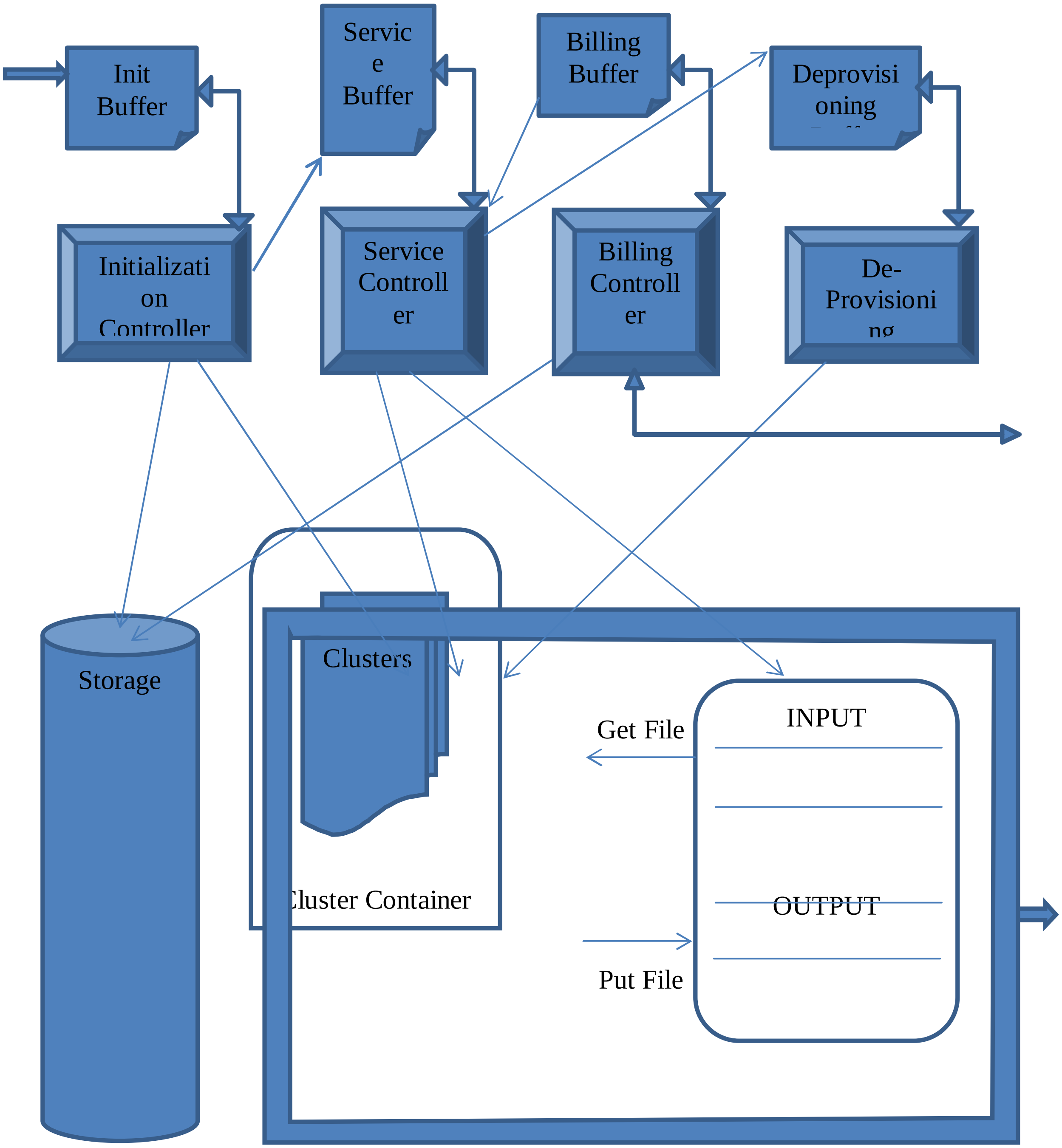

Fig 4: Architectural View

VI. CONCLUSION

This model reduces the huge data set(i.e., Search result given by web services) in to smaller one(i.e., user centric data set) using map /reduce operation, performed on it in distributed and parallel environment. In this model every phase is responsible for its own scalability; they are loosely coupled because of intermediate buffering and hence independent to each other. The map/reduce operation for filtering the result is performed parallel using cluster container services. Number of clusters/nodes can be decreased or increased on demand on pay per use basis; the billing controller is responsible for it.

Building application on fixed and rigid infrastructure is not fruitful for an organization, cloud architecture provides a new way to build applications on demand and scalable infrastructures. The proposed model depicts the way of building such applications.

Therefore without having an upfront investment we are able to run a job massively distributed on multiple nodes in parallel and scale incrementally on demand ,without underutilizing the infrastructure and with in time.

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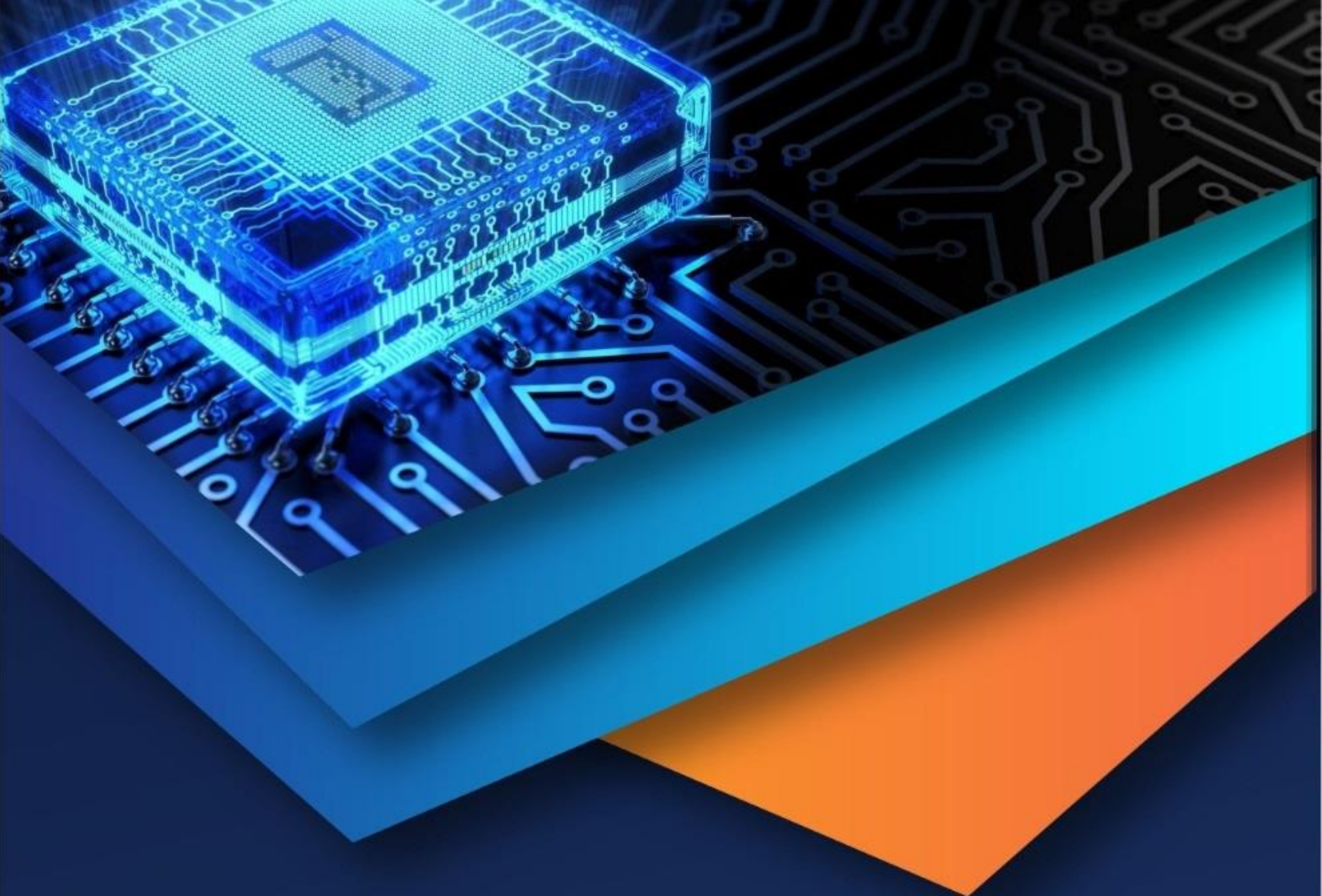

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