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Architecting in the Cloud - How Public Cloud Environments are Helping Software Architects

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Abstract: ***As the new patterns in different zones are risen step by step, the new engineering for different applications is developing. There is an interest from clients for intuitive, rich and dynamic experience on different stages. These requests are fulfilled by the applications having high accessibility, versatility and simple to-execute on cloud stage. A large portion of the associations need to refresh their applications every now and again.***
In this paper, we discuss how these new technologies and the architecture of applications in the public cloud helps the software architects, which can support to achieve above requirements. The applications with this new architecture have multiple services which can deploy independently. These services focus on a minor part of the applications which provide scalability and agility to the applications
Keywords: AWS (Amazon Web Service), Microsoft Azure, GCP (Google Cloud Platform), Cloud Computing, Cloud Architect

I. INTRODUCTION

It offers on interest versatility and adaptability of Information Communication Technology (ICT) (for example Processing, Storage, and Network) assets [1-3] dependent on its utility and administration provisioning approach. Public, Private and Hybrid cloud sending models are utilized to offers ICT assets as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) [1, 2, 4-6]. Distributed computing has been rapidly making advances in a few spaces for structuring, creating, and sending a various arrangement of uses, for example, interpersonal interaction locales, multiplayer gaming entries, logical work process frameworks and endeavor applications [7]

Applications architecture portrays the conduct of uses utilized in a business, concentrated on how they collaborate with one another and with clients. It is centered around the information expended and delivered by applications instead of their inside structure. In application portfolio the board, the applications are normally mapped to business capacities and to application. The applications design is indicated based on business and utilitarian necessities.

This includes characterizing the cooperation between application bundles, databases, and middleware frameworks as far as useful inclusion.

This recognizes any reconciliation issues or holes in practical inclusion. Applications engineering endeavors to guarantee the suite of utilizations being utilized by an association to make the composite design is adaptable, solid, accessible and sensible.

An application engineering chart gives an abnormal state graphical perspective on the application design, and encourages you recognize applications, sub-applications, segments, databases, administrations, and so on, and their co-operations. The application and client area graph demonstrate the geological circulation of utilizations. It tends to be utilized to indicate where applications are utilized by the end clients; the circulation of where the host application is executed or potentially conveyed in customer situations; the dispersion of where applications are created, tried, and discharged, etc. Examination can uncover open doors for legitimization, just as duplication or potentially holes.

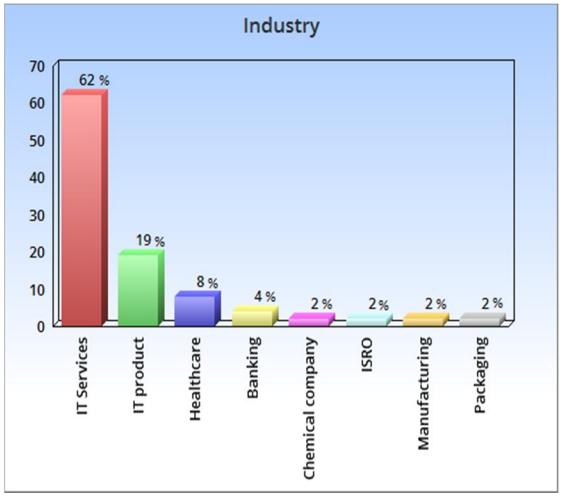
The reason for this outline is to plainly portray the business areas from which business clients commonly communicate with applications, yet additionally the facilitating area of the application framework.

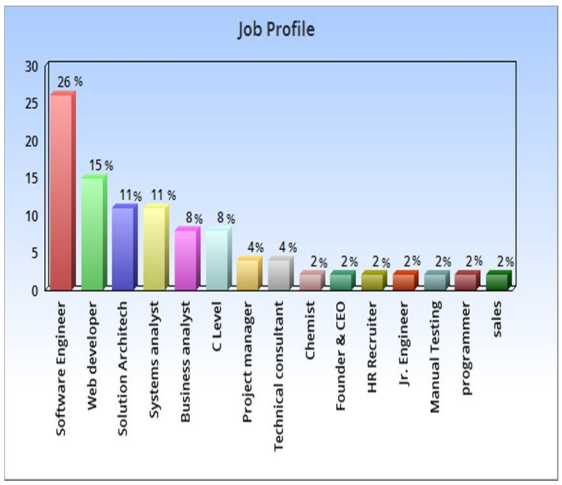
II. METHODOLOGY

For this paper we have directed a survey in which 53 people from various enterprises and different positions in various associations have participated and has given their profitable responses. Likewise we have done secondary research for the meaning of cloud computing and cloud architecture. Additionally we have done primary research to compare 3 noteworthy public cloud service providers like Amazon Web Services, Microsoft Azure, Google Cloud Platform.

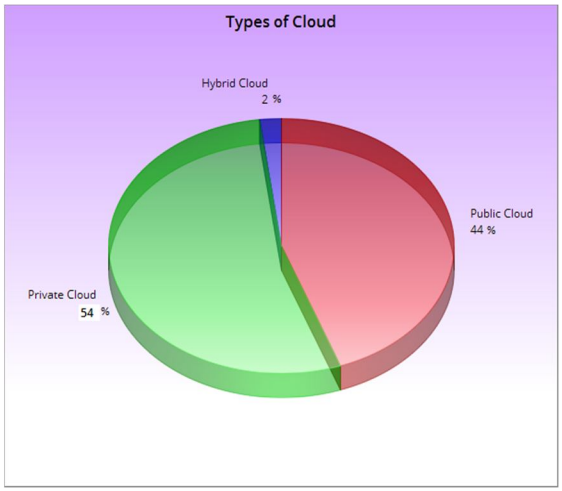
III. SURVEY

We directed a survey and asked individuals from different enterprises who can utilize public cloud for their association to think about how public cloud service is helping them and what benefits are they getting from utilizing public cloud administrations. Likewise, we asked them how would they pick one specific cloud service over another and the reasons in the event that they are not utilizing the other public cloud services. Here are the subtleties of the study.

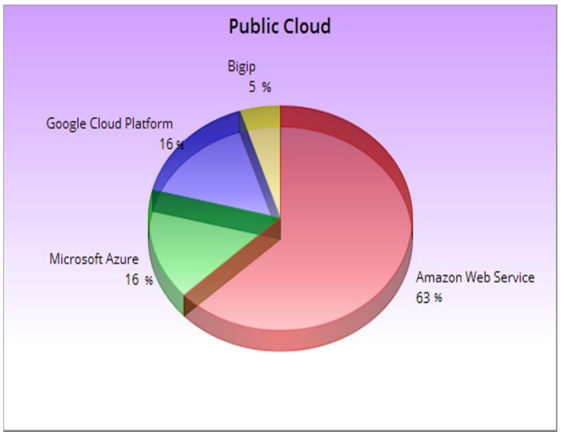




Here is the bifurcation of which kind of cloud is favored by the associations.



Private cloud takes the lead at 54% whereas Public cloud users are 44% and Hybrid cloud has only 2% of user base.



From 44% of people who use Public Cloud services in their organization, 63 % prefer AWS, whereas 16% prefer Microsoft Azure, 16 % use Google Cloud Platform and 5 % use Bigip. From this we can clearly see that AWS is market leader. We shall be discussing this topic in depth in this paper and we will come to know why AWS is the leading public cloud service provider in the market.

There are 19% people who are not using cloud services and the major reason for not using cloud is the security. As the cloud service providers are updating their services, from those 19% people, only16% are looking to use cloud services in future.

We will look into the details of the disadvantage as the paper progresses.

IV. WHAT IS PUBLIC CLOUD?

In a public cloud, outside associations give the framework and the executives required to actualize the cloud. Public clouds drastically rearrange execution and are regularly charged dependent on use. This exchanges the expense from a capital use to an operational cost and can rapidly be scaled to address the association's issues. Transitory applications or applications with burst asset prerequisites normally advantage from the public cloud's capacity to tighten up resources when required and after that scale them back when they are never again required. In a private cloud, the organization would need to arrangement for the most pessimistic scenario over every one of the applications that share the framework. This can result in squandered resources when usage isn't at its peak.Cloud computing architecture alludes to the components and subcomponents required for cloud computing. These segments ordinarily comprise of a front end stage, back end stages, a cloud-based delivery, and a network. Joined, these parts make up cloud computing architecture. Cloud solutions design depends on building methodology and strategies that have been created throughout the last 20 or so years.

V. WHO IS A CLOUD ARCHITECT?

A Cloud Architect is an IT authority who is in charge of conveying managing an organization's cloud computing strategy. This incorporates cloud appropriation plans, cloud application structure, and cloud the executives and observing. Cloud architects direct application architecture and organization in cloud situations.

VI. HOW CLOUD COMPUTING APPLICATION ARCHITECTURE IS DIFFERENT FROM TRADITIONAL APPLICATION ARCHITECTURE?

A. Traditional Application Architecture

Most traditional applications are manufactured utilizing three level application architecture patterns: presentation tier, middle tier, and data tier (see left hand side of the second graph beneath). Every level keeps running on a devoted server and is statically designed with hostnames and IP locations of the servers of alternate levels it relies upon. These applications are sent on static foundation that does not change. traditional applications have next to no information of the foundation they keep running on and they accept the framework won't change or fall flat. In the event that foundation changes or comes up short, these applications can't recuperate. Accordingly, these applications are facilitated on entirely dependable systems and servers. At the point when load is expanded these applications can't consequently scale up or scale out. Or maybe, scaling is done through broad redesign ventures, which experience complete change management cycle of the association and secure extra equipment that is installed, and application is re-designed to suit new servers.

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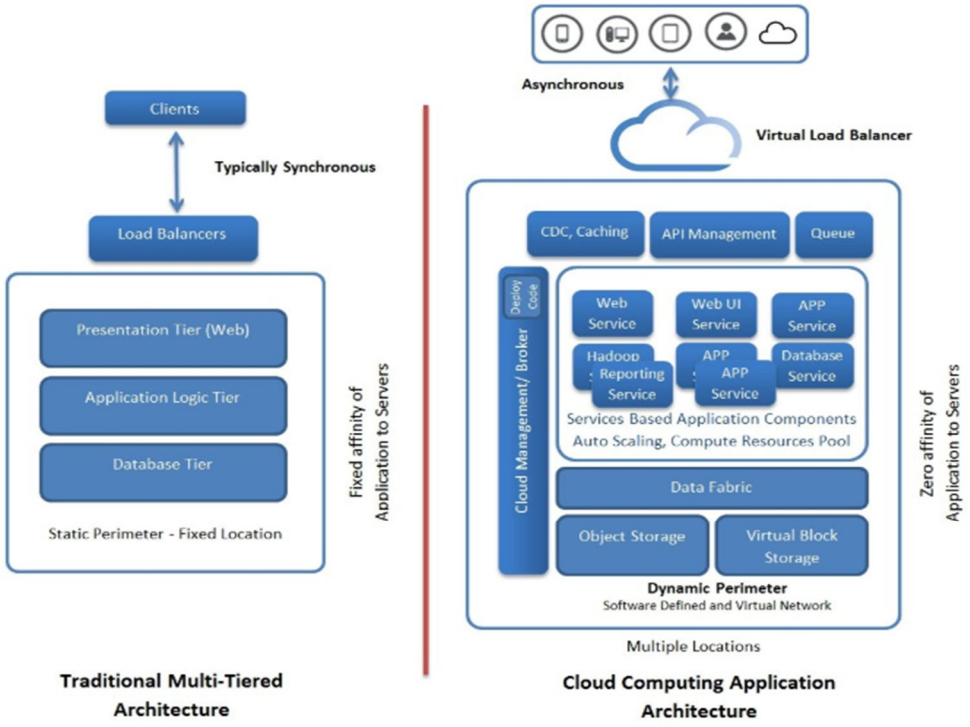
With the reception of server virtualization innovation numerous associations moved their customary applications on virtual servers. Virtualization empowered associations to utilize their figure assets all the more productively and diminish the time and cost that was required to arrangement new servers. Be that as it may, the application architecture did not change much because of server virtualization; the applications arrangement still stayed static. A few associations went to the following dimension and sent virtualization mindful load balancer between applications levels to scale these applications nearly on interest autonomous of different levels. Be that as it may, database level presented numerous confinements since each application part expected to interface with a solitary wellspring of truth database.

So as to comprehend the cloud architecture design, it is essential to comprehend the architecture of the cloud infrastructure. The reason being that cloud infrastructure architecture has affected (or constrained) the cloud application architecture to change.

B. Cloud Computing Application Architecture

The way that cloud architecture empowered the utilization of infrastructure on the fingertips of developers. The engineers before long understood that so as to use this capacity completely, they should change their application architectures. Albeit traditional application can be sent on a cloud infrastructure as a Service (IaaS) stage, the traditional three level architecture does not give the adaptability required to use the cloud infrastructure abilities like versatility, self-serve and wide assortment of figure and capacity administrations.

Give us a chance to take a case of database to comprehend contrasts between two architectures. The traditional applications utilize single database that stores all the application data and afterward gives the data put away in it to different application segments when they ask. As the information develops the database turns into a bottleneck for most applications and regularly the database can't be scaled out, it must be scaled up. When we take a gander at the cloud architecture, we see that there are a wide range of choices to store the information (for example Article stockpiling, No-SQL database, RDB, Cache stockpiling, Data distribution center, Data Archive stockpiling, Elastic square stockpiling). Along these lines, rather than putting away every one of the information in a solitary database, the information can be partitioned dependent on its use necessities and afterward each sort of information can be put away on a cloud storage service that best meets its prerequisites. For instance, the information that does not change frequently, yet requires broad read solicitations and adaptability, can be put away in an object storage service. Or on the other hand, on the off chance that an application requires dynamic connections between the information objects, at that point No-SQL database can be utilized.



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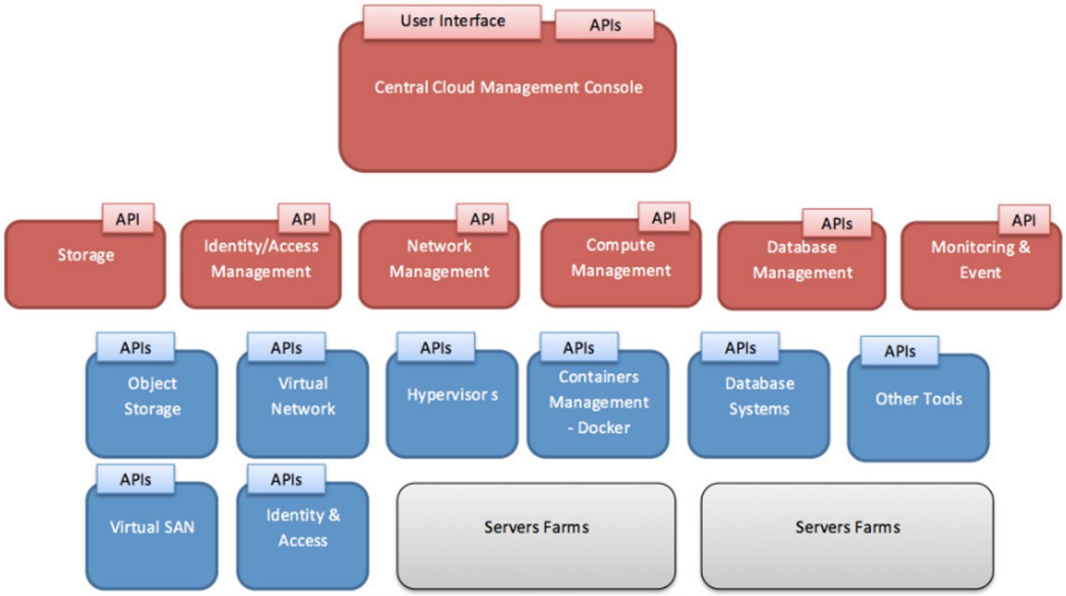
VII. CLOUD APPLICATION ARCHITECTURE AND SOFTWARE ARCHITECT (SA)

Software Architecture (SA) assumes an imperative job in cloud-empowered frameworks. Software Architect is an individual generally working inside an extent of one application (system). His fundamental assignment is to screen the entire framework, see all associations between parts on a given dimension of reflection, just as to characterize constraints and prerequisites for source code. The job of SA in cloud computing should be surely knew regarding how SA can configuration cloud-based frameworks and can encourage the connecting of the hole between higher-level abstractions and low-level algorithmic details. In some cases, there is a solitary application, here and there a whole arrangement, comprising of littler undertakings, for a specific organization which a SA needs to oversee. This implies architect jobs, with the most conceptual look on undertaking that require steady participation with business (Enterprise, once in a while Solution) which makes the errand of SA exceptionally troublesome.



Note: This diagram does not represent any specific cloud provider's architecture. It is only a logical representation of the concept of cloud layer in the cloud infrastructure.

VIII. HOW CLOUD SOFTWARE ARCHITECTURE DIAGRAM HELPS THE SOFTWARE ARCHITECTS

A. Adaptation

Adapting systems to changing prerequisites is regularly important to ensure right and fulfilling execution. Self- adaptive software frameworks can alter their conduct in light of their view of the earth and the framework it-self. This has been drawn nearer as a prerequisites engineering problem, yet the requirement for a software architecture point of view is perceived.

B. Dynamic Models and Control

Requirements need a portrayal at run-time to permit self-adaptive systems to collaborate with the earth, i.e., 'self-reflect' through models that connect in the basic leadership process important to change the fundamental framework Dynamically adaptive systems manage requirements as powerfully oversee able models, established through a 'self-prediction' based controller that actualizes a control theory-based input circle. Self-adaptiveness, self-reflectiveness and self-prescience are the foundations of the operational sid—DevOps and Continuous Development. Microservices are rising as a variation of service-oriented architecture (SOA), going for acknowledging programming systems as sets of little services, each deployable on an alternate stage and running in its very own procedure while speaking with one another through lightweight components without centralized control. Microservices move us towards consistent advancement and conveyance.

C. Dev Ops

Microservices require full application stacks; their infrastructure resources (e.g., information stores and systems) must be overseen sufficiently. DevOps provides this connection from programming advancement to innovation activities and quality management; compartment innovation and cloud-local services give cloud-based virtualization and usage support [8].

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IX. ADVANTAGE OF THE CLOUD APPLICATION ARCHITECTURE TO APPLICATION ARCHITECT

To convey a future state architecture that catches the guarantee of Cloud Computing, architects need to comprehend the essential advantages of Cloud computing.

A. Decoupling and detachment of the business administration from the foundation expected to run it (virtualization).
B. Adaptability to pick different merchants that give dependable and versatile business administrations improvement situations, and framework that can be utilized out of the crate and charged on a metered premise—with no long haul contracts.
C. Elastic nature of the framework to quickly distribute and de-assign greatly adaptable resources to business benefits on an interest premise.
D. Cost distribution adaptability for clients needing to move CAPEX into OPEX .
E. Reduced expenses because of operational efficiencies, and increasingly fast arrangement of new business administrations.

X. DISADVANTAGE

Public clouds have the weakness of hosting your information in an offsite association outside the legitimate and administrative umbrella of your association. Moreover, as most public clouds influence an overall system of server farms, it is hard to report the physical location of information at a specific minute. These issues result in potential administrative consistence issues which block the utilization of public clouds for specific associations or business applications.

XI. COMPARISON BETWEEN 3 MAJOR PUBLIC CLOUD SERVICE PROVIDER

Cloud computing technology is spreading throughout is pure like a wildfire and the top three providers of this cloud computing technology are Amazon Web Services Microsoft Azure and Google cloud platform. Choosing one amongst these top contenders is always a difficult task. Amazon Web Services was established in year 2006 with 12 years of experience it's the most popular player in the market. It offers wide range of services across storage, compute, analytics, database and many other fields. After like six to seven years of AWS, Azure was launched by Microsoft. Due its vaguer compared to AWS it has quickly built a reputation for itself in the market and just like AWS it offers complete set of cloud services. Same as Microsoft Azure Google cloud platform was launched as well. The main reason of introducing GCP was to power their own services like YouTube and Google search but later on they built enterprise cloud services as well, so you can say that Google cloud platform is still an evolving. Let's compare these cloud providers based on the services they offer.

Compute Services	amazon web services™	Azure	Google Cloud Platform
Virtual Servers	EC2 Services	Virtual Machine	Google Compute Engine
Platform-as-a-Service	AWS Elastic Beanstalk	Azure Cloud Services	Google App Engine
VPS Made easy	Amazon LightSail	Virtual Machine Image	----------
Container Management	EC2 Container Service	Container Service & Container Registory	Container Engine
Serverless Computing	AWS Lambda	Functions	Cloud Functions (Beta)

So first let's consider compute services. The compute services offered by all these three cloud providers are equally powerful and yet unique in their only. Amazon's primary compute service is EC2 which is elastic cloud compute. As for the Microsoft its primary compute service is known as virtual machine. Unlike Amazon's EC2, this virtual machine provides enhance security hybrid cloud capabilities and integrated support for Microsoft software. Similar to Amazon's EC2 and Microsoft Azure virtual machine, Google cloud platform offers compute engine. This compute engine offers automatic price discounts and it runs on an infrastructure that uses half the energy of typical data center. Now let's take a look at additional compute services. All these cloud providers provide a combination of IaaS, PaaS and SaaS services but to say platform as a service is a strong suit of Microsoft. So Microsoft Azure offers cloud services using which you can easily deploy scale and draw in an application. On cloud Amazon's elastic beanstalk and Google's Google App Engine are similar to this Azure cloud services. Let's say you want to deploy a virtual private server without

bothering about the underlying infrastructure then Amazon Lightsail is the best option. Similar to Amazon lightsail, in Microsoft Azure offers virtual machine engine and Google cloud platform is yet to launch similar service. So all this cloud providers also support container platform and they offer their own unique server less computing services as well. To conclude in terms of compute all the three cloud providers offer equally powerful compute services, but Google cloud platform is still lagging behind in some areas. Now moving on to storage services.

A. Storage Services

Storage Services	
	• Amazon Aurora • Relational Database Services • Amazon DynamoDB • Simple Storage Services • Elastic Block Storage • Elastic File Storage • Amazon Glacier • Amazon Redshift
	• Basic Storage – 4 • SQL options – 3 • No SQL - 2 • Azure Data Warehouse • Azure Backup - 3
	• Cloud Storage • Cloud Spanner • Cloud SQL • Cloud Bigtable • Cloud Datastore

AWS offers a long list of storage services. To name some it offers simple storage service, Elastic Block Storage and Elastic File Storage. Talking about database options it offers Amazon Aurora high-performance relational database, Amazon RDS and dynamo DB managed no SQL database.

AWS also offers a cloud-based data of warehouse which we know as Amazon redshift. Though it doesn't offer a backup service, it offers Amazon glacier for long term archival storage at very low rates. Then talking about Microsoft Azure it offers way more storage services than compared to AWS and just for the basic storage it offers four options and four databases it offers six to five options and like AWS it also offers cloud-based data warehouse which we call Azure data warehouse and unlike AWS Microsoft offers an actual backup service called Azure backup. In addition to this Azure backup it also offers site recovery and archival storage. A final contender Google cloud platform when compared to AWS and Microsoft Azure offers less number of storage services with the storage services like cloud spanner and cloud BigTable are quite popular and it doesn't offer backup or any archival storage service. so in terms of storage, Amazon Web Services and Microsoft Azure stand neck to neck whereas Google cloud platform has still long way to catch up with Amazon and Azure.

B. Key Cloud Tools

Key Cloud Tools	
	• Athena • QuickSight • Sagemaker • Lex • GreenGrass IOT • AWS Lambda • Deep Lense
	• HD Insights • Data Factory • Azure ML Studio • Azure Bot Service • Cognitive Service • IOT Hub • Functions
	• Big Query • Cloud Dataflow • Cloud ML Engine • Cloud IOT Core • Cloud Functions

All these vendors are actively launching services aimed at cutting edge technologies like surveillance computing, machine learning, analytics and IOT. If you talk about Amazon Web Services, it offers Athena and QuickSite using which you can get data insights. It also offers machine learning service called Sagemaker and Lex using which you can build voice and text chat Bots, and as for the IOT devices it offers green gasps IOT messaging app and as for Microsoft it has invested heavily in artificial intelligence and it offers a machine learning service called ML studio and Bot service called Azure Bot service. In addition to this it also offers cognitive services like BingSearch API, text analysis API computer vision API and many other services. Google cloud platform has known for its analytical background. Big query enables interactive analysis of massively large datasets. In addition to all this, it also offers IOT service and computing services but still they're in beta version.

AWS provides nice and easy page to start using their services. They break it down by platform you want to work on so whether you're making an iOS app or writing in PHP they provide you some sample code so that you can easily get started. For Microsoft Azure and Google cloud platform, the segregation of services here is not that great when compared to AWS that's mostly because they are less experienced. You need to get used to before you feel comfortable to start using their services.

XII. SUMMARY

When building up the architectural vision, an enterprise architect should remember the attributes of cloud computing just as consider a portion of the hierarchical and social issues that may progress toward becoming deterrents to the selection of things to come state architecture. While advancing, choices must be made on whether the future-state technical architecture ought to stress similarity with the present standard or begin sans preparation to limit cost. Future state frameworks architecture designs include exchange offs between lower cost/operational effectiveness and more noteworthy adaptability. Utilizing an Enterprise Architecture structure can help enterprise architects explore the exchange offs and plan a framework that achieves the business objective.

XIII. CONCLUSION

To finish up Amazon Web Services still stays to be the most prominent cloud supplier generally on account of the seven years head begin it has once again its rivals and AWS services are unquestionably more developed and practically rich when contrasted with different services. That we can see from our review that about 63% of the organizations use AWS. Its partner Microsoft Azure, however it was propelled quite a while after AWS, it's doing genuinely well in the market. It has its firm establishment and is effectively contending with Amazon Web Services. You shouldn't be astonished in the event that it surpasses Amazon Web Services in not so distant future. At that point our last contender Google cloud stage when contrasted with AWS and Microsoft Azure is as yet not unreasonably mainstream but rather it's known for its estimating methodologies and machine learning and article instruments it offers, yet other than that it has far to get together Amazon Web Services.

The best cloud processing stage is the one that is reasonable for you and it totally relies upon what you anticipate from these cloud suppliers or what sort of services you need from these cloud suppliers.

XIV. ACKNOWLEDGMENTS

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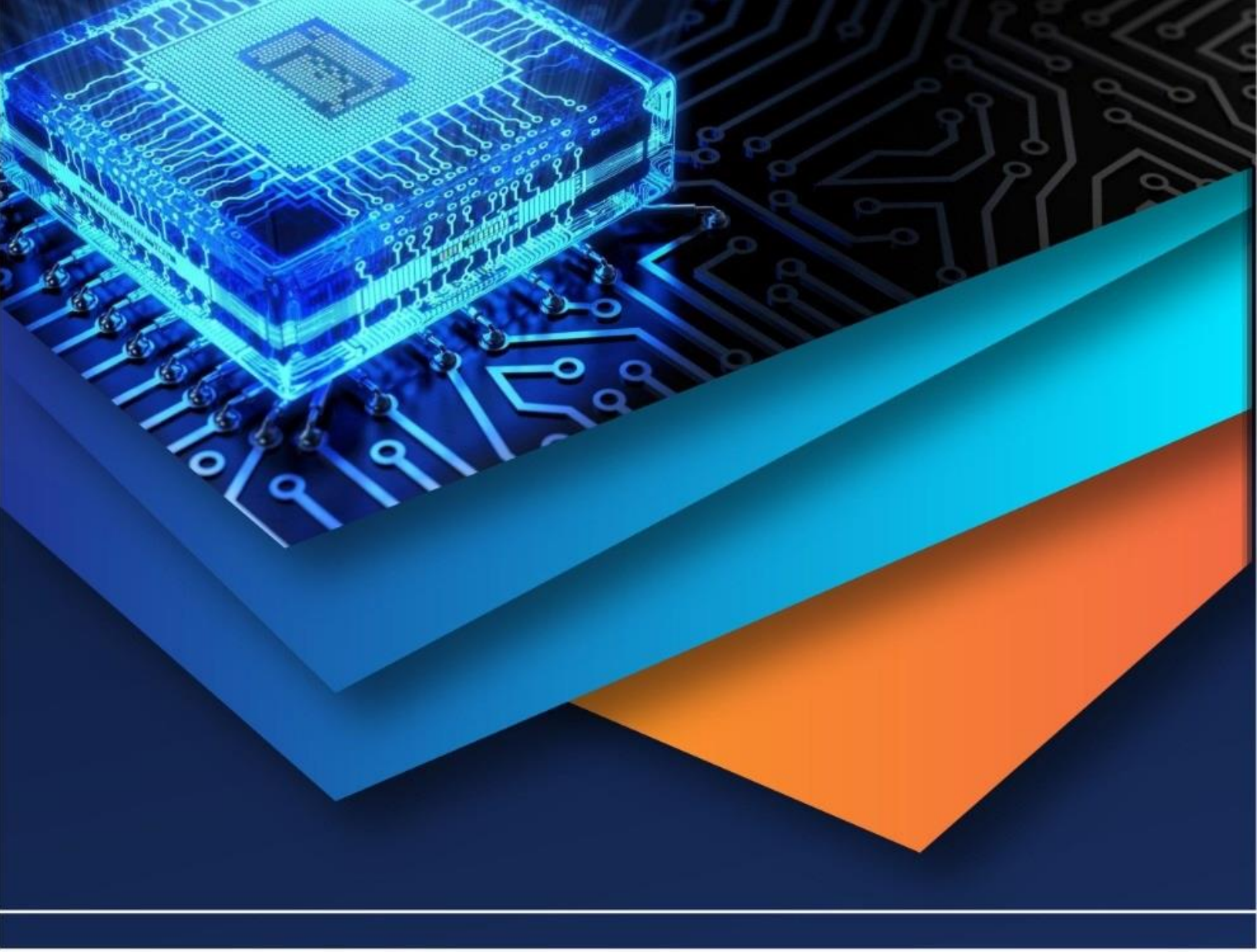

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