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REVIEW PAPER ON COMPARISON OF AWS, MICROSOFT AZURE AND GOOGLE CLOUD PLATFORM

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ABSTRACT

Pay-as-you-use cloud computing refers to the on-demand provision of computing resources via the Internet. Cloud solution providers like Microsoft Azure, Amazon Web Services (AWS), and Google Cloud Platform (GCP) offer cloud solutions like processing power, memory, and databases on an as-needed basis, saving users from having to buy, run, and maintain physical computers, hardware, and servers. This study compares the performance and service of the three primary cloud computing platforms—Google Cloud Platform, Amazon AWS, and Microsoft Azure—as well as the architecture and types of cloud computing services. The three systems have all been tested in the same virtual environments, namely Ubuntu 16.04 micro instances. Performance is measured using the benchmark application Phoronix Test Suite 10.4, and this paper evaluates the results for the RAM speed, Dbench, and Apache benchmarks. Just as ludicrous as the assertion that cloud computing doesn't introduce new security issues is the claim that cloud computing is inherently unsafe. Through the use of cloud computing, resources can be dynamically increased without requiring in-depth familiarity with a completely new infrastructure, hiring new staff, or developing new software.

I. INTRODUCTION

The process of accessing resources, software, and databases over the Internet and beyond the limitations of local hardware is referred to as "cloud computing" or, more specifically, the "cloud". This technology allows businesses to scale their operations with flexibility by delegating most or all of the management of their infrastructure to outside hosting companies. A set of practices and technological tools called cloud security are intended to counteract both uinternal and external risks to the security of businesses. As they advance with their digital transformation strategy and integrate cloud-based tools and services into their infrastructure, organizations require cloud security.

Amazon.com provides a comprehensive and popular cloud computing platform called Amazon Web Services (AWS). Launched in 2006, AWS has since become a leading player in the cloud services industry, providing a vast array of cloud-based solutions and services to individuals, businesses, and organizations of all sizes. AWS is designed to help users build and deploy applications, store and manage data, and scale their computing resources in a flexible and cost-effective manner.

Azure, also known as Microsoft Azure, is a reliable and extensively used cloud computing infrastructure and platform offered by Microsoft. Since its launch in 2010, Azure has developed into a top cloud service provider, providing a vast array of cloud-based services and solutions to people, companies, and organizations across the globe.

Google Cloud, also known as GCP (Google Cloud Platform), is a top cloud computing platform and service provider that Google provides. Since its 2008 launch, Google Cloud has grown in popularity quickly and is now well-known for its state-of-the-art technology, vast global network, and variety of cloud-based solutions that serve a wide range of industries and use cases.

II. CLOUD SERVICES

The cloud computing services that are most popular and extensively used are:

- **IaaS (Infrastructure-as-a-Service):** A hybrid approach, in which businesses use cloud providers to handle their server, hardware, networking, virtualization, and storage needs while managing a portion of their data and apps on-premise.

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- **PaaS (Platform-as-a-Service):** provides a custom application framework that automatically manages operating systems, software updates, storage, and supporting infrastructure in the cloud, enabling organizations to streamline the development and delivery of their applications.
- **SaaS (Software-as-a-Service):** software that is hosted in the cloud and is usually accessible through a subscription model. By managing servers, storage, middleware, data, and other technical issues, third-party providers reduce the cost of IT resources and streamline support and maintenance tasks.

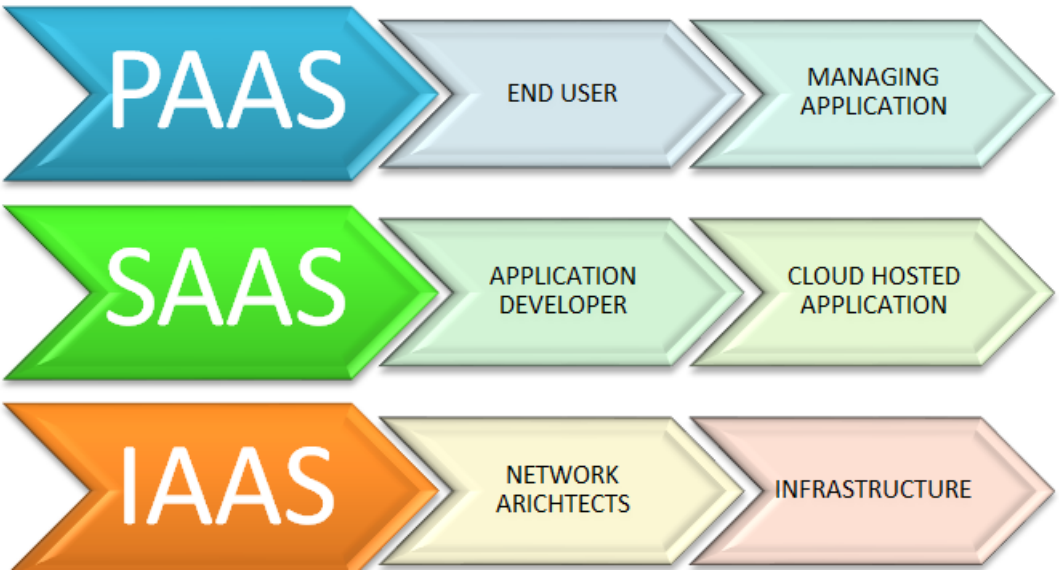

Fig 1: Cloud Services Model

III. MICROSOFT AZURE

Similar to how Google has Google Cloud and Amazon has Amazon Web Service, or AWS.000, Microsoft has its own cloud platform called Azure. In general, it's a platform that lets us make use of Microsoft's assets. For instance, setting up a large server will require a significant amount of money, time, space, and other resources. That's where Microsoft Azure comes into play. To ease our workload, it will give us access to virtual machines, quick data processing, analytical and monitoring tools, and more. Azure's pricing is likewise more straightforward and economical. Often known as "Pay As You Go," this approach allows you to only pay for the actual amount that you use. It is a well-known variant of Microsoft Azure v1, which was followed by Microsoft Azure v2. Microsoft Azure v2 features an interactive user interface (UI) for ease of learning and simplification, while v1 was more JSON script-driven. Early in October 2008, Microsoft unveiled Windows Azure; however, it wasn't until February 2010 that it went online. Microsoft Azure was the new name for Windows Azure later in 2014. A service platform for.NET services, SQL services, and numerous Live services was offered by Azure.

IV. FEATURES OF AZURE

By utilizing the framework already established by Microsoft's software and business app offerings, it has repurposed and proposed a number of quickly delivered, easily configured services, such as:

- Cloud development platform
- Blockchain technologies
- Predictive analytics
- Comprehensive IoT integration
- DevOps features

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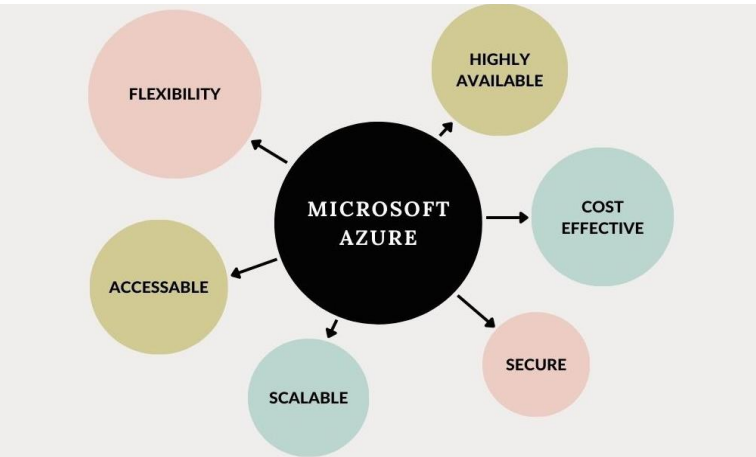

Fig 2: Functionality of Microsoft Azure

V. GOOGLE CLOUD PLATFORM

Although Google is said to have started operating in 2008, it has only lately emerged as a significant rival of Azure and AWS. Like the other two platforms, GCP provides IaaS and PaaS in addition to a serverless platform with computation, storage, databases, various networking options, and database and IoT administration. Twenty nations and territories currently offer Google Cloud Platform, with three more to follow. We can use Google's products, including YouTube, Gmail, and the search engine, thanks to it. This platform is used by the majority of businesses to create, move, and launch cloud applications with ease. It enables us to use a high-speed internet connection to access these applications. One benefit of GCP is its support for multiple databases, including SQL, MYSQL, Oracle, Sam, and others.

Cloud computing services such as computing, data analytics, data storage, and machine learning are offered by Google Cloud Platform (GCP). Google provides a public cloud computing service called Google Cloud Platform. Examples of its many services include computing, networking, storage, big data, developer tools, IOT, cloud AI, data transfer, identity & security, and cloud computing. Google Cloud Platform is a globally recognized enterprise. High security is a feature of Google Cloud Platform, while GCP offers larger networking and a more advantageous pricing structure

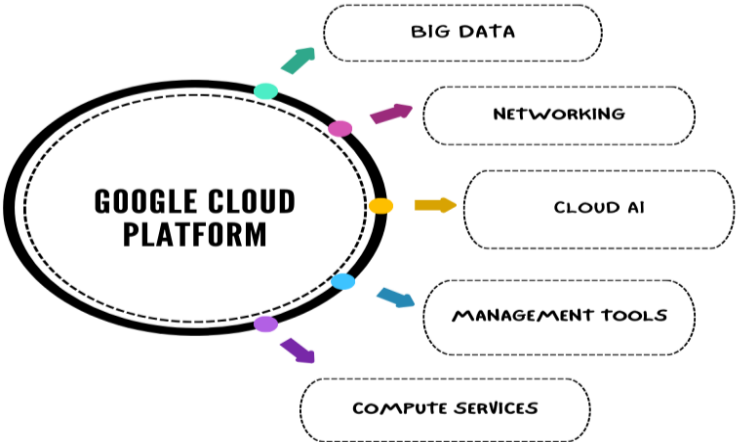

Fig 3: Features of Google Cloud Platform

On-demand services: Automated environment with web-based tools. Therefore, no human intervention is required to access the resources.

Broad network access: One can access the information and resources from any location.

Resource pooling: Users have access to a shared pool of computing resources whenever they need them.

Rapid elasticity: The availability of more resources whenever required.

Measured service: Easy-to-pay feature enables users to pay only for consumed services

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VI. AWS (Amazon Web Services)

Amazon's cloud service platform is called Amazon Web Services (AWS). Among other things, it offers users computation, storage, and delivery. When these infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) offerings are combined, the result is a scalable method for the business to quickly deploy applications. Every AWS account holder worldwide has access to these resources. The accounts are completely separate from one another. Account holders of AWS can access on-demand IT resources at no upfront cost through a pay-as-you-go pricing model. Because you can only pay for the services you use or require, Amazon Web Services offers flexibility. Businesses use AWS to lower the capital costs associated with constructing their own private IT infrastructure, which can be costly depending on the size and type of the business. AWS has a physical fiber network of its own that links to Edge locations, Availability zones, and regions. AWS also covers all maintenance costs, saving businesses a tonne of money.

VII. FEATURES OF AWS

- Computing
- Storage solutions
- Cloud app integration
- Analytics and machine learning
- Productivity tools
- Developer and management tool

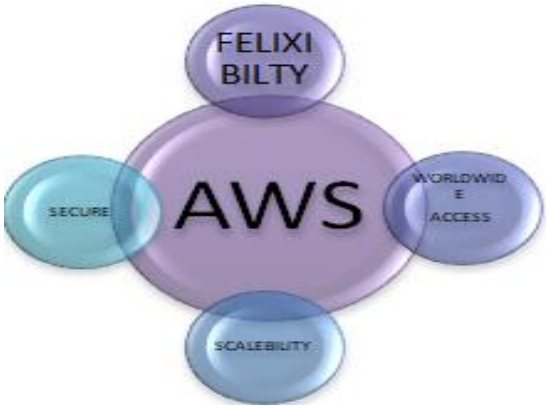

Fig 4: Features of AWS

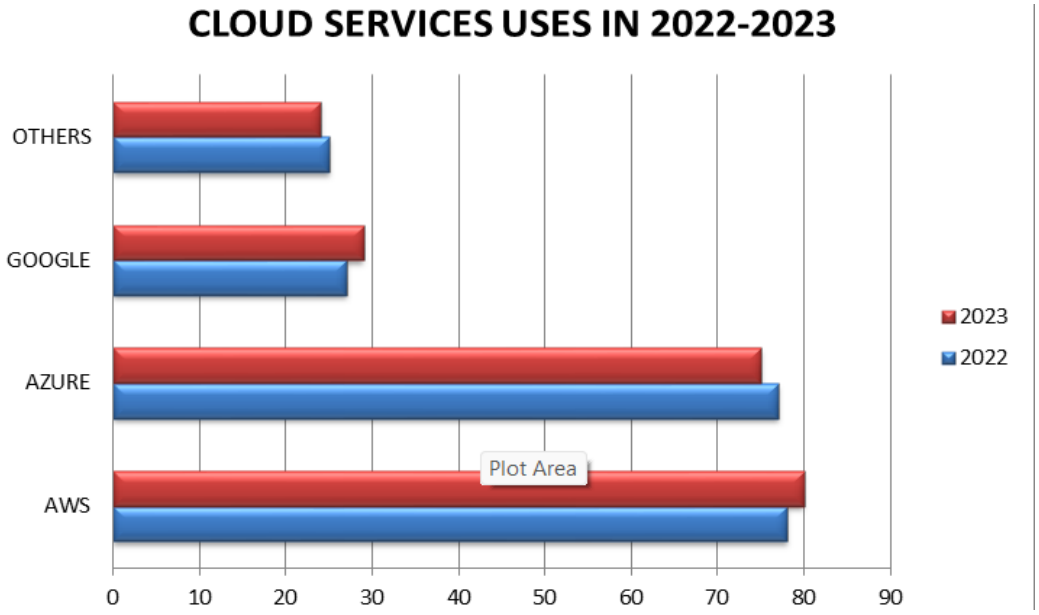

Fig 5: Cloud Services Uses In 2022-2023

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VIII. COMPARISON BETWEEN AWS, MICROSOFT AZURE AND GOOGLE CLOUD PLATFORMS

Comparison between AWS, Microsoft Azure and Google cloud platforms			
Parameters	AWS	Google Cloud	Microsoft Azure
General			
Starting Year	2006	2011	2010
Available regions	16	21	52
Computing types provided	SaaS, PaaS & IaaS with major contributions in IaaS	SaaS, PaaS & IaaS with major contributions in PaaS	SaaS, PaaS & IaaS with major contributions in PaaS
IDE Support	SDK support for Eclipse	Direct support in Cloud9 IDE	SDK support for Eclipse & Visual Studio
Database and Virtualization			
Databases	1. MySQL 2.PostgreSQL 3. MariaDB 4. MongoDB	1. Cloud SQL 2. Cloud spanner 3. Cloud Bigtable 4. Cloud Firestore	1. Azure SQL
Virtual machine types	1. General purpose 2.Compute Optimized 3. Memory optimized 4. storage optimize	1. Standard machines 2. High-memory machines 3. High-CPU machines	1. General purpose 2.Compute Optimized 3. Memory optimized 4. storage optimize
Pricing			
Pricing Types	On-Demand, per-second billing	Pay as you go, on-demand per second billing	Pay as you go pricing
Specification			
Server OS types	Linux, Windows	Linux, Windows	Linux, Windows
Pre-configured OS	1. Amazon Linux 2. Cent OS 3. Debian 4. Oracle Linux	1. Cent OS 2. Debian 3. Ubuntu 4. Red Hat Linux	1. Cent OS 2. FreeBSD 3. OpenSUSE Linux 4. Oracle Linux
Available runtimes	1. .NET 2. JAVA 3. PHP 4. Python	1. Python 2. JAVA 3. Node 4. PHP	1. .NET 2. JAVA 3. Node 4. PHP
Machine Learning Frameworks Supported	1. Apache 2. MXNet (With Gluon API) 3. TensorFlow 4. Caffe framework	1. TensorFlow 2. DistBelief 3. Many in-built API's to support development	1. PyTorch 2. TensorFlow 3. Scikit-learn 4. MXNet
Support and Administration			
Support Available	24/7, Forums, self-help resources, documentation	Responses takes minimum of 15 mins (with top tier pricing) & upwards of 1 day,	24/7, forums, live chats, telephonic communications, documentation

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		telephonic communications, forums, training, documentations	

IX. AWS IS BETTER THEN COMPARISON OF MICROSOFT AZURE AND GOOGLE CLOUD PLATFORM

- AWS has a five-year head start.
- There are various locales and accessibility zones in AWS.
- Around 33% of the market is held by AWS.
- The development pace of GCP is practically 100 percent.
- Premium clients using each of the three cloud stages
- There are various administrations presented by AWS
- Most Broadly Utilized Blockchain on AWS
- All major working frameworks are upheld like MacOS, Windows.
- Enormous choice of administrations
- Constant development of administration determination
- Development and accessibility

Amazon Web Administrations is effortlessly dissected as being at the highest point of all the significant cloud suppliers in the present cloud fight between Microsoft Sky blue, Amazon AWS, and Google Cloud. Given Microsoft Purplish blue and Google Cloud Stage are reliably climbing the rundown of the top cloud pioneers, it is challenging to guess how long Amazon Web Administrations will rule as the top cloud supplier. While Sky blue and Google Cloud Stage additionally have benefits, Amazon AWS has the novel advantage of being the first of its sort. Numerous organizations that use Microsoft apparatuses find that utilizing the Sky blue cloud stage seems OK since it simplifies it to utilize MS devices. The main explanation clients ought to pick Google Cloud Stage is on the grounds that it has the best valuing structure for the administrations, including YouTube and Google Search. Considering the investigation report, it would be desirable over contend that picking the best cloud specialist co-op for your necessities is a higher priority than picking the best cloud specialist organization generally speaking.

X. ANALYSIS OF THE COMPARISON

The main focus of this essay is a comparison of the three main cloud service provider platforms: Microsoft Azure, Google Cloud Platform, and Amazon EC2. The three main players in the field are briefly introduced at the outset of the paper, which then compares their similarities and differences.

The comparisons above were analyzed, and the findings are listed and categorized below:

• General:

Of the three, Microsoft Azure is the cloud platform that is most widely used.

Cloud9 is a direct IDE support offered by the Google Cloud Platform.

The eldest of the three, Amazon EC2, is well-versed in the IaaS service model.

• Database & Virtualization:

Google Cloud Platform offers the most database options, while Azure offers the fewest. o The greatest variety of virtualization options is offered by Amazon EC2.

• Pricing:

Each of the three offers customized pricing plans based on usage for each customer.

• Specifications:

Amazon EC2 has the most pre-configured OS, but Microsoft Azure offers the most support for ML frameworks.

The platform offered by Google Cloud has the most runtimes.

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• Support:

In the form of forums and documentations, all three platforms offer a wealth of support.

XI. SCOPE

The degree is tremendous, and every stage has its assets and interesting contributions. Picking among them frequently relies upon explicit task prerequisites, existing innovation stack, and inclinations. The extent of these cloud stages traverses businesses like money, medical care, online business, and that's just the beginning. They empower organizations to scale assets powerfully, improve security, and influence trend setting innovations like man-made intelligence and AI. Every stage has extraordinary highlights, and the decision frequently relies upon explicit business necessities and inclinations.

XII. CONCLUSION

Large-scale storage solutions and fast data processing are essential given the daily influx of new start-ups and the increasing amount of data that users consume. The cloud platforms offer a solution to these issues through virtualization, which is the process of building numerous virtual machines on a single physical machine. As a result, the processor operates more efficiently and spends less time idle.

Each of the three cloud platforms that were previously compared has advantages of its own that make them effective in different contexts. Although Amazon EC2 is the most established and supports the greatest number of pre-configured operating systems, it is not as widespread or as readily available as other options. In a similar vein, while the Google Cloud Platform supports an enormous amount of databases and has an excellent collection of built-in libraries, it does not support SDKs and uses a pay-to-help model where the length of the support period varies depending on the service tier selected. Out of the three, the Microsoft Azure platform has the widest reach, but its database support is quite lacking.

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