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Comparative Evaluation of Cloud Pricing Models: Insights from Aws, Microsoft Azure, and GCP

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ABSTRACT

A comparison is made between the pricing strategies of popular cloud platforms, including Google Cloud Platform, Microsoft Azure, and Amazon Web Services. The research paper looks at the structure, cost-effectiveness, flexibility, and applicability of several pricing schemes, such as pay-as-you-go, reserved instances, and spot pricing. By highlighting the advantages and disadvantages of each model, the research seeks to offer recommendations for strategic planning and ideal cloud cost management through case studies and analytical comparison. Highlighting important cloud computing and associated service companies, such as AWS, Microsoft Azure, and GCP. It outlines study objectives to find and suggest the most effective pricing methods for companies and describes how comparing cloud pricing models can be difficult. According to the results, choosing the appropriate price plan and cloud platform is crucial for cost savings and scalability without sacrificing performance or dependability.

Keywords: AWS, Microsoft Azure, GCP, Cloud Service Providers, Cloud Computing, Cloud Pricing

I. INTRODUCTION

A shared pool of computer resources, including servers, networks, apps, and software, may be accessed by users at any time and from any location thanks to the cloud computing idea. "Cloud computing" is the result of combining the terms "cloud" and "computing". The term "cloud" refers to the Internet and data centres for hardware and software, whereas "computing" refers to the use or operation of computers. This is because the cloud is something that exists remotely. Using the Internet to distribute computer resources is known as cloud computing [1]. In 2025, AWS held a 29% market share in cloud infrastructure, followed by Azure (22%), and GCP (12%), according to Gartner. The oldest and most popular cloud platform, Amazon Web Services , was introduced in 2006 and provides a wide range of

services and worldwide infrastructure. It is a popular option for startups, businesses, and governmental institutions because it offers more than 200 fully functional services from international data centres [2]. "A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" is the most widely used definition of the cloud computing model, according to the National Institute of Standards and Technology (NIST). A distributed system that is connected to a number of virtualized and interconnected computer systems and is dynamically provisioned or introduced in accordance with more unified computing resources that are mainly based on service level agreements is known as cloud computing [3]. Companies that offer cloud-based network services, infrastructure, platforms, software, or business apps are known as cloud service providers. Customers, whether individuals or businesses, can access the cloud services through the data centre of the cloud provider using an internet connection. Suppliers respond to requests from customers by providing cloud solutions [4].

The structure of this document is as follows. In Section II (**Overview of cloud pricing models**), highlights the cost structures, use-case suitability, and provider-specific benefits and limitations of the Pay-as-You-Go, Reserved Instances, and Spot Instances pricing models offered by AWS, Azure, and GCP, In Section III (**Methodology**),The methodology evaluates cloud providers on pricing, usability, and performance metrics by examining benchmark data and scholarly and online sources. In Section IV (**About Aws, Microsoft Azure and Gcp**), AWS, Azure, and GCP are described in this section along with their histories, key characteristics, market positions, and special advantages in the context of cloud computing, In Section V **(Comparative Analysis of Cloud Providers),**This section presents a detailed comparative analysis of AWS, Azure, and GCP across key aspects such as pricing, performance, features, usability, security, and service offerings as introduced earlier, In Section VI **(Recommendations and Best Practices),** offers practical suggestions and best practices to assist businesses in selecting the best cloud provider and pricing structure while minimizing expenses and coordinating with workload and business requirements. In Section VII **(Result),** demonstrating how well they match the various organizational workload requirements as stated in the study's goal, Discussed in Section VIII(**Conclusion and Future Work**), is the last part of something, its end or result.

II. OVERVIEW OF CLOUD PRICING MODELS

Pay-as-You-Go, Reserved Instances, and Spot Instances are the three primary cloud pricing models that are compared. These models, which are provided by the three main cloud service providers—Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP)—are essential in assisting businesses in selecting the pricing plan that best suits their workload needs. The Pay-as-You-Go model is a flexible pricing structure that does not require an upfront payment and instead charges customers according to their actual usage of cloud services. For companies with erratic or fluctuating workloads that might not require constant cloud resources, it is perfect. Among the three providers, AWS has the lowest hourly rate, which makes it affordable for workloads that are smaller and less frequent. However, in comparison to other models that provide discounted rates for long-term usage, this one may become more costly as workloads increase over time. GCP provides competitive pricing for workloads that are extremely flexible, while Azure's Pay-as-You-Go option seamlessly integrates with Microsoft tools[5].

When businesses are willing to commit to cloud services for a long time (one to three years), the Reserved Instances model works well for workloads

that are predictable and long-term. Compared to Pay-as-You-Go,Reserved Instances provide substantial cost savings, particularly for consistent and dependable cloud usage. Because it has the lowest hourly rate, AWS is a good choice for loyal customers. Competitive pricing is also provided by Azure and GCP, albeit at somewhat higher costs. However, this model's primary flaw is its lack of flexibility, as clients are forced to sign a fixed-term contract that restricts their ability to scale up or down in response to shifting business requirements [5]. The Spot Instances model is designed for workloads that are highly adaptable, cost-sensitive, and resilient to disruptions. Customers can buy unused cloud capacity with Spot Instances at a substantial savings over the other pricing models. The drawback is that, based on demand, cloud providers have the right to end these instances whenever they want. AWS is the most economical choice because it offers Spot Instances at the lowest price per hour. GCP is the most economical choice for short-term, burst workloads because it provides comparable flexibility at a marginally lower hourly rate. The primary drawback is the unpredictability of availability, which could interfere with important tasks [5][6-7].

III.METHODOLOGY

To achieve the objectives, both a theoretical and an empirical approach were used. A theoretical literature review is used to compare three public cloud service providers: Google Cloud, Microsoft Azure, and Amazon AWS. The literature survey will review books, journals, research papers, theses, online studies, and other materials that support the analysis of cloud service providers. This criteria helps to compare different cloud providers: cost, pricing model, access interface, customer support, documentation, programming languages, data security, operating system, Windows support, free trial, and regions. Cloud Harmony benchmark providers evaluate the service availability of cloud service providers [3].

IV. ABOUT AWS, MICROSOFT AZURE AND GCP

GCP, AWS, and Azure Each platform has its own specialties, features, and cost structures. AWS has traditionally held the largest market share, followed by Microsoft Azure. Even though it is currently the third largest, Google Cloud Platform has been steadily increasing its market share [8].

Amazon Web Services: Amazon Web Services , a safe platform for cloud services, offers features like content delivery, processing power, and database storage to help businesses grow. Since its establishment in 2006, AWS has spent millions of dollars developing and managing the vast, reliable, and efficient IT infrastructure that supports one of the largest online retail platforms globally. Amazon can be considered to have succeeded in its goal, as it now boasts hundreds of thousands of customers worldwide [9].

Microsoft Azure: The company's main infrastructure as-a-service concept, Microsoft Azure, was released in June 2012. Hyper-V is the hypervisor used by this utility. The Windows Azure Platform provides a programming model for creating scalable applications in addition to tools to scale and lower the computational resources of apps and services. The development, hosting, and management environments of the Azure Services Platform are powered by Microsoft Azure, the cloud services operating system. Microsoft data centres can use Windows Azure, which provides developers with on-demand compute and storage, to host, scale, and manage online applications and services. Customers of Microsoft Azure can choose to use cloud services either solely on the cloud or in combination with any existing data centre, applications, or infrastructure [10].

Google Cloud Platform: With this platform, users can develop, test, and release an application with reliable infrastructure. This platform can utilize processing, storage, and application services for backend, mobile, and web solutions. It only provided online documents, calendars, and email when it first entered the cloud market in 2008. A pre-defined runtime environment

for Python and Java is used by Google Cloud Platform (GCP), a web application hosting service, to create and implement cloud-based applications [10].

Providers	Benefits	Limitations
AWS	• Scope and depth of services • Provides everything, including networking and robotics. • Most reliable and secure. • Support for big businesses	• Costly • There aren't many options for hybrid clouds. • Challenging to use • The cost of technical assistance
MS Azure	• Accuracy and Expandability • Support for open-source • First-Largest Provider • The integration and transfer of current Microsoft services are simple.	• Fewer service options compared to AWS • Expensive • Relatively Challenging to use • Need for Platform Expertise
GCP	• Compatible with other Google services and products. • Deep understanding technology • Cost Advantage over Competitors • Recent innovation and well-authorized cloud computing	• Limited support for enterprise use cases • Lack of privacy and safety • Insufficient features or services • Limited control and flexibility

TABLE:1 BENEFITS AND LIMITATIONS OF CLOUD SERVICE PROVIDER [11][12]

V. COMPARATIVE ANALYSIS OF CLOUD PROVIDERS

A. Comparative Analysis of AWS, Microsoft Azure and GCP

Three of the most popular cloud computing platforms—Google Cloud Platform , Microsoft Azure, and Amazon Web Services will be compared [13].

- **Pricing:** A variety of pricing options, including spot instances, reserved instances, and pay-per-use, are available on the three platforms. AWS is the most costly, and GCP is the least. Nevertheless, the price might change based on the good or service being used [13].
- **Performance:** All three systems offer high levels of scalability, reliability, and availability. AWS, on the other hand, has long dominated this market thanks to its extensive network of data centres and wide range of services [13].
- **Features:** AWS provides the most functionality, even though each platform has its own distinct set of features and services. Microsoft Azure is a leader in hybrid cloud and AI/ML, while GCP is well known for its expertise in big data and analytics [13].
- **User Interface:** The user interfaces of each platform vary greatly, but Amazon's is the most intricate and challenging for novices to use. Microsoft Azure has an easier-to-use interface, but GCP provides a more contemporary and uncomplicated user experience [13].
- **Security:** All three platforms have robust security features, but AWS has the most comprehensive security features and certifications. Microsoft Azure also offers a robust security infrastructure, even though GCP is well-known for its use of encryption and secure networking [13].
- **Support:** Every platform provides varying levels of assistance, ranging from community forums to premium ongoing support. AWS has the best support community, but Google Cloud Platform and Microsoft Azure provide similar levels of assistance [13].

- **Integration Capabilities:** Strong integration with Google's services and open-source tools allows GCP to support machine learning and data analytics applications. It may take more effort to integrate with non-Google services [14].
- **Usability:** GCP's console is commended for being user-friendly and intuitive, making it appropriate for users who are not familiar with cloud services.
- **Compute Services:** Businesses have several options for hosting application code, including AWS, Azure, and GCP. In this context, "Compute" refers to the resource hosting model of the application [8].
- **Storage Services:** AWS, Azure, and GCP offer a wide range of services, including data storage for virtual machine (VM) discs
- **Networking:** You can use a range of networking options from AWS, Azure, and GCP either separately or in combination.
- **Data Warehouse:** A data warehouse stores raw data, metadata, summary data, and processed operational data in one location for easy user access. Data warehouse options are available from AWS, Azure, and GCP [8].

Parameters	AWS	MS AZURE	GCP
Launch Year	2006	2010	2008
Market Share	32	23	10
Pricing	1.Pay-as-you-Go 2.Reserved Instances 3.Spot Pricing	1.Pay-as-you-Go 2.Reserved Instances 3.Spot Pricing	1.Pay-as-you-Go 2.Committed use discounts 3.Sustained use discounts
Performance	1.Highly Performance 2.Scalable 3.High Availability	1.Highly Performance 2.Scalable 3.High Availability	1.Highly Performance 2.Scalable 3.High Availability
Features	1.Rich feature set 2.Wide range of services 3.Large Ecosystem	1.Rich feature set 2.Wide range of services 3.Large Ecosystem	1.Rich feature set 2.Wide range of services 3.Large Ecosystem
User Interface	1.Robust 2.Steep Learning Curve	1.Robust 2.Steep Learning Curve	1.User-friendly 2.Easy to use
Security	1.Highly secure 2.Compliance with regulations	1.Highly secure 2.Compliance with regulations	1.Highly secure 2.Compliance with regulations
Support	Extensive	Extensive	Extensive
Integration	Extensive third-party support	Seamless with Microsoft Products	Best with Google Services, good for open-source tools.
Usability	Feature-rich, steeper learning	User-friendly, Ideal for Microsoft Users	Intuitive, user-friendly console
Data Warehousing	Amazon Redshift	Azure Synapse analytics	Big Query
Compute	Amazon EC2 Instances	Azure virtual machines	Compute Engine
Storage	AWS Simple Storage Service	Azure Blob Storage	Cloud Storage

Parameters	AWS	MS AZURE	GCP
Networking	Virtual Private Cloud	Virtual Network	Virtual Private Cloud

Table:2 Comparative Analysis of cloud providers [8][13][14].

VI. RECOMMENDATIONS AND BEST PRACTICES

The best practices and practical advice to help businesses select the best cloud provider and pricing structure. Making this choice is essential to striking a balance between performance, scalability, and cost.

A. Choosing the Right Cloud Provider and Pricing Model

Choosing the right cloud provider and pricing model requires understanding the organization's specific needs, the types of workloads being run, and budget constraints [15].

1. **Understand Workloads:** Understanding the nature of the workloads is the first step. Pay-as-You-Go provides flexibility and charges according to actual usage, making it perfect for sporadic or short-term needs. Because Reserved Instances provide discounts in exchange for a fixed commitment, they are economical for steady, long-term operations. Spot Instances offer the lowest prices for flexible, cost-sensitive tasks like development or batch processing, but they might be interrupted when demand increases [16].
2. **Consider the Strengths of Each Cloud Provider:** Because of its scalability and extensive service offerings, AWS is well-suited for a variety of workloads, making Reserved Instances and Pay-as-You-Go beneficial. Businesses that already use Microsoft environments can benefit from Azure's strong integration with Microsoft products. Google Cloud Platform (GCP) offers competitive rates on Pay-as-You-Go and Spot Instances, making it an affordable choice for compute-intensive and AI/ML tasks [17].
3. **Match Pricing Models to Budget and Growth Needs:** Pricing models must be in line with the organization's growth objectives and budget. Pay-as-You-Go can be useful for temporary requirements, but if usage is consistent over time, it could get costly. Reserved instances offer predictable costs and are the ideal option for consistent usage. Spot instances offer the greatest savings at the risk of termination and are ideal for non-critical tasks with flexible timing [18].
4. **Focus on Scalability:** Businesses anticipating rapid growth should gravitate towards flexible models like Pay-as-You-Go or Spot Instances, as all major providers support auto-scaling and load balancing. Reserved Instances guarantee cost effectiveness and resource availability for steady growth [19].
5. **Use Cloud-Native Tools for Cost Management :** To track usage, set cost alerts, and optimize resources, businesses should use cloud-native tools like Google Cloud Operations Suite, AWS Cloud Watch, or Azure Monitor. These tools support data-driven decision-making, inefficiency identification, and the avoidance of needless spending. Businesses can maximize performance and cost while planning for future requirements by integrating cloud strategies with these best practices [20].

B. Best Practices for Cloud Cost Optimization

1. **Regularly Review Cloud Spending:** Because cloud expenses can rise quickly, it's critical to periodically assess spending in order to spot inefficiencies and prevent paying for capacity that isn't being used [21].
2. **Use Reserved Instances for Long-Term Workloads:** Reserved instances provide significant cost savings for workloads that are predictable. Access to essential resources at a reduced cost is guaranteed by long-term commitments [21].
3. **Utilize Spot Instances for Temporary or Flexible Workloads:** Spot instances are a great way to save

money on non-essential tasks. For flexible workloads that can withstand disruptions, they are perfect [22].

4. **Monitor Performance and Costs Using Cloud-Native Tools:** To monitor performance and resource usage, use monitoring tools. This prevents unnecessary spending and guarantees improved control over cloud resources [23].
5. **Negotiate Enterprise Contracts:** In order to obtain discounts, reserved capacity, and dedicated support for extensive cloud usage, think about negotiating enterprise contracts with cloud providers [22].
6. **Regularly Optimize the Cloud Environment:** The process of optimizing the cloud is ongoing. To guarantee that cloud services continue to be effective and economical, periodically reevaluate the infrastructure requirements [22].

VII. RESULTS

The Best Cloud Pricing Models (AWS, Microsoft Azure, GCP) depends on the specific needs and workload characteristics of the organization.

Pay-as-you-Go Model:-The Pay-as-You-Go model is a flexible pricing structure where customers are charged based on their actual usage of cloud services, without requiring an upfront payment.

AWS: Compute resources that are charged by the hour or by the second (with a minimum of 60 seconds), enabling users to make long-term commitment-free payments for just the services they use.

Microsoft Azure: Charges according to actual usage and allows users to scale resources up or down based on demand with per-minute billing available for the majority of services .

GCP: For its virtual machines and other resources, it uses per-second billing, which offers flexibility and cost savings by only charging for the precise moment that resources are used.

Reserved Instances:The Reserved Instances model is suited for long-term, predictable workloads where organizations are willing to commit to cloud services for an extended period (1-3 years).

AWS Reserved Instances : Offer substantial price reductions (up to 75%) over On-Demand rates in return for a one- or three-year commitment. RIs offer flexibility in instance attributes and come in Standard and Convertible options.

Microsoft Azure Reserved Instances: Provide virtual machine commitments of one or three years at a cost savings of up to 72%, with the flexibility to swap or cancel reservations as business requirements evolve.

GCP Reserved Instances : Give consumers the option to commit to a certain usage (such as memory or CPUs) for a period of one or three years in exchange for discounts of up to 70% for memory-optimized machine types and up to 57% for general-purpose machine types.

Spot Instances:The Spot Instances model is designed for highly flexible, cost-sensitive workloads that can tolerate interruptions.

AWS Spot Instances: Give users the option to bid on extra compute capacity at discounted prices (up to 90% off on-demand prices), making it appropriate for workloads that are flexible and fault-tolerant.

Azure Spot instances: Provide unused capacity at a reduced cost; this is perfect for workloads that are subject to unforeseen terminations.

GCP : Offer temporary, economical instances that can save up to 80%, which the Google Cloud Platform can pre-empt when resources are required elsewhere.

VIII. CONCLUSION AND FUTURE WORK

The Research paper represents a comprehensive comparison of the three most popular cloud pricing models across AWS, Azure, and GCP: Pay-as-You-Go, Reserved Instances, and Spot Instances. Businesses can choose the cloud provider and pricing model that best suits their needs based on workload types, financial constraints, and scalability requirements by weighing the cost-effectiveness, scalability, and flexibility of these types. The study's main finding is that, while

AWS and Azure provide significant advantages for long-term, predictable workloads, with AWS offering greater flexibility, GCP is the most economical choice for variable workloads.

The results show how crucial it is to choose the best cloud platform and pricing structure in order to minimize expenses and guarantee scalability without sacrificing dependability or performance. Companies should keep an eye on their spending, assess how they use the cloud, and modify their pricing policies to suit changing operational requirements. Organizations can maximize their cloud expenditures, match their cloud strategies with long-term objectives, and make sure they are using the best resources for their needs by heeding the advice given.

FUTURE WORK

Future research could explore the following areas:

1. **Emerging Cloud Pricing Models:** Additional insights into optimizing cloud costs may be obtained by looking into novel or developing cloud pricing models, such as multi-cloud pricing strategies or "pay-per-use" with more detail.
2. **Performance and Cost Benchmarking:** Future research could examine the trade-offs between cost and performance in practical settings, taking into account the dynamic nature of workloads and contrasting cost and performance metrics.
3. **Cloud Pricing Model for Hybrid Cloud Environments:** Businesses using private and public clouds may find useful insights from a thorough analysis of pricing models' performance in hybrid cloud environments.
4. **Integration of Artificial Intelligence and Machine Learning:** Analyzing the effects of incorporating AI/ML tools into resource allocation and cloud cost management may give businesses better tools for future cloud usage optimization.
5. **Sustainability and Green Cloud Computing:** Investigating the energy efficiency and environmental impact of cloud providers and pricing models would be beneficial for businesses looking to lower their carbon footprint, as sustainability is becoming a top priority for businesses.

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