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Comparison of Different Cloud Providers

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Abstract: ***It is a better alternative for enterprises and ordinary people to use cloud service providers' services (IaaS, PaaS, SaaS, DaaS, and so on) and pay as you go. There are already a huge number of service providers on the market, and finding a good supplier for long-term needs is tough owing to the range of features and services.***
Amazon, Microsoft, and Google are the top three providers in terms of market share. The goal of this article is to introduce cloud consumers to the most prominent Cloud Service Providers (CSPs). We also compare and contrast these CSPs based on a variety of parameters linked to the services they supply. Before moving their business to the cloud, the analysis described in this article can assist people and companies in making key judgments on the benefits and costs of cloud technology.
Keywords: Amazon, AWS, Google Cloud Platform, Microsoft Azure, GCP, CSP's, Cloud Service Providers.

I. INTRODUCTION

The demand for cloud services has risen quickly in recent years, resulting in a significant increase in the scalability of cloud platform users. Cloud computing has emerged as one of the most important technologies in today's globe. Cloud advantages have a direct impact on service providers and customers. Companies such as Microsoft, Google, Amazon, Verizon, and Rockspace adjust their pricing schemes on a frequent basis in order to give a more customer-friendly service. Platforms for cloud services provide a wide range of services, including storage, upload, and download. From a traditional technique to a new cloud approach, cloud computing has changed the way data is stored and managed. Cloud computing allows for cost-effective and efficient data management. Between the consumer and the service provider, the cloud offers a variety of SLA certificates.Customers can choose from a variety of price options and perks provided by the cloud. Price is a critical factor for every firm that delivers cloud-based services because it has a direct impact on consumer needs and corporate revenues. The economy, stocks, earnings, and losses are all affected by pricing[1].
Cloud computing pricing is relatively variable and customizable, depending on the customer's needs and the skill of the service provider. Customers receive assured quality of service (QoS) from the service provider. Although service pricing is now based on a set business framework in the technology industry, this tendency is changing. Newer pricing models have emerged in this service field as a result of newly evolving value chain models implemented by traditional IT services with the emergence of cloud computing[4].

A. *Characteristics of Cloud Computing*

Cloud computing technology has a number of intriguing features that make it a possible solution for a variety of problems that individuals and companies confront. The following are some of these characteristics:[10]

1) *Scalability:* The cloud is a large-scale solution; Google, Yahoo, and Amazon, for example, have hundreds of thousands of servers located throughout the world. With small changes to cloud architecture and software, CSPs can add new nodes and servers to the cloud.
2) *Virtualization:* At the virtual level, cloud isolates physical resources from users, allowing users to access any resources they require without having to worry about physical interconnection details.
3) *Dependability:* The use of several redundant processing nodes (replication) ensures excellent service reliability, making cloud computing more reliable than local computers.
4) *Versatility:* Cloud computing isn't limited to a single use case. The cloud can handle a large number of apps and allow them to run in parallel.
5) *Elastic Resource Pooling:* Users think of the cloud as a limitless pool of resources that can be allocated and released quickly and flexibly based on their needs.
6) *On-Demand Measured Services:* You can rent services based on your needs; cloud services are similar to water, electricity, and gas in that they can be charged based on how much you use.

7) *Economic:* Clouds may be developed with very low-cost nodes, and centralized management allows businesses to avoid the high management costs of data centers.
8) *Maintainability:* CSPs are responsible for the upkeep of the infrastructure, whether it is hardware or software. The IT team in an organization would have less headaches as a result of this.
9) *Easy Management:* Cloud-based applications that require a lot of storage are easier to use and administer than on-premises applications. At the user level, all you really need is a simple web browser and access to the internet.
10) *Cost Savings:* Cloud computing allows SMEs to dramatically reduce their IT spending. For infrequent application of intensive computing resources, expensive systems are not necessary. In addition, the amount of manpower required for such systems is significantly reduced. Even simple apps, such as email, may be set up quickly and at a low cost with Google Apps.
11) *Disaster Recovery:* In the event of a disaster, having an offsite backup is always beneficial. For most businesses, keeping critical data backed up via cloud storage services is a must. CSPs also make certain that they have disaster recovery procedures in place.
12) *Green Computing:* The main disadvantages of today's computing systems include harmful emissions caused by widespread usage of systems in businesses, electronic trash accumulated over time, and energy consumption. This can be reduced by employing cloud computing services, which are environmentally friendly and produce minimal e-waste.

II. LITERATURE SURVEY

Cloud computing offers various advantages and disadvantages, both of which are caused by the fact that all data and applications are kept on the Internet. Because cloud-based data and apps may be accessed in real time and online. It can be applied to a wide range of everyday tasks, including schooling. Cloud computing is a concept that allows users to access a shared pool of resources on demand. [2].

A. *Major Cloud Computing Service-Providers*

There are several cloud-computing service providers available in industry. Few leading companies are listed below as per Gartner's Magic Quadrant 4 [3]:

- Amazon Web Services – Launched in 2006
- Microsoft Azure - Launched in 2010
- Google Cloud Platform - Launched in 2008
- Alibaba Cloud - Launched in 2009
- Oracle Cloud- Launched in 2012
- IBM Cloud- Launched in 2011

Identifying a cloud type or service is a one-of-a-kind decision. No two clouds (even if they're of the same type) are alike, and no two cloud services are utilized to solve the same problem. However, understanding the common factors will help you better understand how the limitations of each cloud computing model and cloud service may affect your organization [9].

The most widely used services are as follows:

1) *Amazon Web Services*

Amazon [6] is a popular CSP that provides a variety of cloud services, including:

a) Amazon EC2 (Amazon Elastic Compute Cloud): It is a cloud computing service that provides computer capability.
b) Amazon S3 (Amazon Simple Storage Service): is a cloud storage service focused to high availability.
c) Amazon RDS (Amazon Relational Database Services): is a set of cloud-based tools for managing databases.
d) Amazon SimpleDB: The main database functionality are provided by Amazon SimpleDB.
e) Amazon Route 53 (Amazon scalable DNS): is a service that provides safe routing servers across the Internet.
f) Amazon CloudFront: is a service dedicated to managing and distributing high-speed multimedia across the Internet.
g) Amazon Elastic MapReduce: is a cloud-based web service that allows clients to process large volumes of data.

2) Google Cloud Platform

Google Cloud Platform is a cloud computing platform developed by Google. In 2007, Google [7] entered the cloud market with basic services like email, calendars, and online documentation. Google now offers a number of cloud services, including:

a) Compute Engine: It is a software-as-a-service platform that allows users to run large-scale workloads on virtual servers housed on Google's infrastructure.
b) App Engine: App Engine is a PaaS that allows clients to build apps on top of pre-built high-performance platforms.
c) Cloud Storage: Customers can use Google's secure and reliable cloud storage services to store any sort of file of any size.
d) Cloud SQL: Deals with relational databases using various database management systems (DBMS).
e) Cloud Datastore: Cloud Datastore is an unstructured database management solution.
f) BigQuery: As a result of the recent big data revolution, Google now offers a specific service for processing enormous amounts of data called BigQuery.

3) Microsoft Azure

IMicrosoft launched Microsoft Windows Azure [8] in late 2009, kicking off the cloud services. Microsoft Windows Azure is a cloud-based platform that provides a variety of services, including:

a) Infrastructure: on-demand, scalable, and high-performance infrastructure with comprehensive support.
b) Web development: provides a strong framework for web application development and deployment.
c) Mobile development platform: a cloud-based platform for developing and testing mobile applications.
d) Media: Media is one of Microsoft Windows Azure's competitive advantages, and it's dedicated to generating, editing, and releasing any sort of media.
e) Storage: a cloud storage solution for managing and processing data, whether it's small or large.
f) Big data cloud: an Apache Hadoop-based big data solution.
g) Identity and access management: The user can deploy Active Directory to the cloud and manage access with a single sign-on.

TABLE 1. Comparison Between AWS & GCP & Azure

Service	Amazon Web Service	Google Cloud Platform	Microsoft Azure
Service provided	Iaas, Paas, Storge, Database	Iaas,Paas, Storage,mobile,database, Big Data	Iaas, paas, mobile, Media, Database, Big Data
Average Monthly price	66 $	42.2 $	65.7 $
Build, test, and deploy	CodeBuild, CodeDeploy CodePipeline	Cloud build	Azure devops Github Enterprise
Control and observe requests	Amazon SQS, Amazon SNS	Cloud Tasks	Azure service bus
Manage resources via K8's	AWS controllers	Config Connectors	Azure Service Operator
Exchange routes(VPC)	Amazon VPC	Cloud Router	Azure VPN gateway
Conversational AI	Amazon LEX	DialogFlow	Azure Conversational AI
Auto ML models	SageMaker	VertexAI	AutoML
Text-to-Speech	Amazon Poly	Text-to-speech	Text-to-speech
Network traffic	Elastic Load Balancer	Cloud Load Balancing	Azure Load Balancing

Pranay Dutta et al. [3] suggested that despite AWS having the largest share of the cloud service industry, it would be unfair to state that it delivers the best solutions. If you're seeking for simple business solutions or fool proof security, MS Azure and GCP have a variety of features. The notion is that when it comes to Cloud Service Providers, there is no universal best, it all comes down to what best meets your needs.

B. Growth of Service Providers and their Popularity

Amazon Web Services (AWS) is one of the market's oldest providers, having been founded in 2006. Cloud storage, database service, analytics, network Internet of things, mobile computing, and enterprise services are among the computing services it offers. As a result of these services, an organization can develop at a faster rate, cut costs, and scale up its operations. AWS is one of the most well-known cloud platforms available, as it is one of the oldest cloud platforms on the market. As a result, AWS is widely used. AWS (Amazon Web Services) has 63 availability zones throughout the world.

Figure 1. Amazon Web Services Growth Since 2004

Google created the Google Cloud Platform (GCP) in 2011 to provide cloud computing services to its clients. Storage, big data, databases, analytics, cloud AI, network, mobile computing, development tools, management tools, Internet of things, cloud security, and data transmission are among the services offered by GCP. There are 21 availability zones in Google Cloud Platform (GCP). worldwide.

IBM, Google, Amazon, and Microsoft are all competing to give the best cloud services to their customers. Amazon and Microsoft are believed to be the world's main tech giants since they dominate the US and UK markets. There is a vast list of businesses that offer cloud services. Small digital companies have begun to invest in the cloud area in recent years. When compared to Microsoft Azure and Google Cloud Platform, Amazon Web Services (AWS) has the largest market share (GCP).

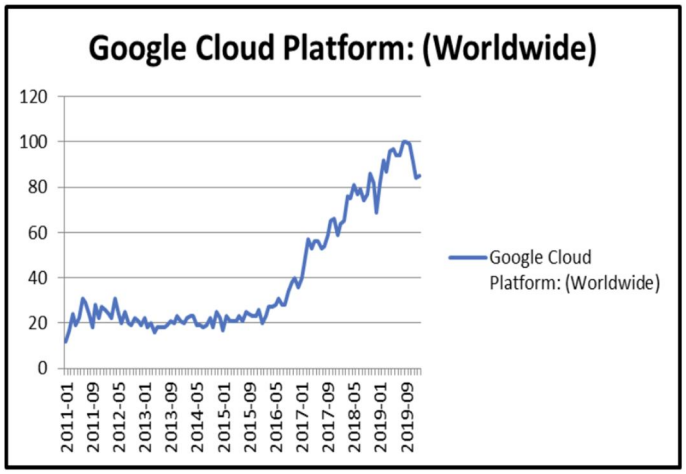

Figure 2. Google cloud platform (GCP) since 2011

Figure 3 depicts the growth of three cloud service platforms during the previous five years. Amazon Web Services (AWS) has definitely outpaced Microsoft Azure and Google Cloud Platform (GCP) in terms of global popularity during the previous five years.

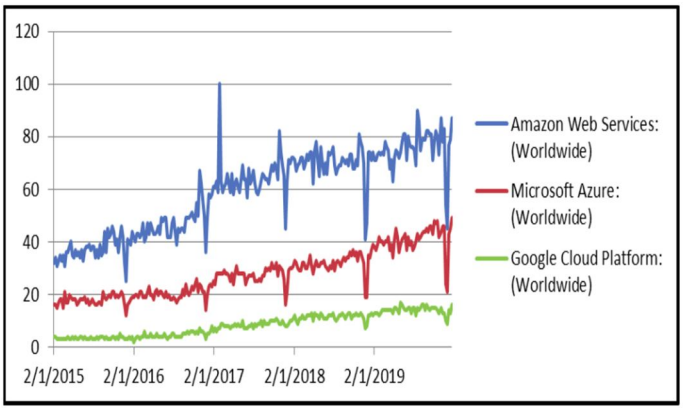

Figure 3. Amazon Web Services (AWS) vs Microsoft Azure vs Google cloud platform (GCP)

There are numerous big clients like Netflix, Facebook, BBC, Adobe, Twitter, BMW, Disney, Expedia, and a slew of other companies are among them. Delaware Resource Group, Erickson Advisors, Hudson River Fruit Distributors, and others are among Microsoft Azure's clients. Spotify, HSBC, Snapshot, HTC, Philips, Coca-Cola, Domino's, Sony Music, and others are GCP clients.

III. CONCLUSION

There are other service providers in the market, and this paper compares the costs of the major three cloud platform providers, as well as the fundamental pricing schemes for Amazon Web Services, Microsoft Azure, and Google Cloud Platform. Customers may concentrate on their business rather than technological issues with these platforms. On-demand services, flexibility, support, and security are all features shared by all three platforms.

AWS was the first to join the market, and consumers who are looking for a dependable product to meet all of their technological needs often turn to Enterprise cloud services. Because of its exceptional service quality, Microsoft has established itself as the most trusted name in Enterprise organizations in terms of consumer trust and confidence. However, Google Cloud has a lot to offer in terms of innovation, and Google is involved in a lot of little project innovations, which means that larger firms have fewer options.

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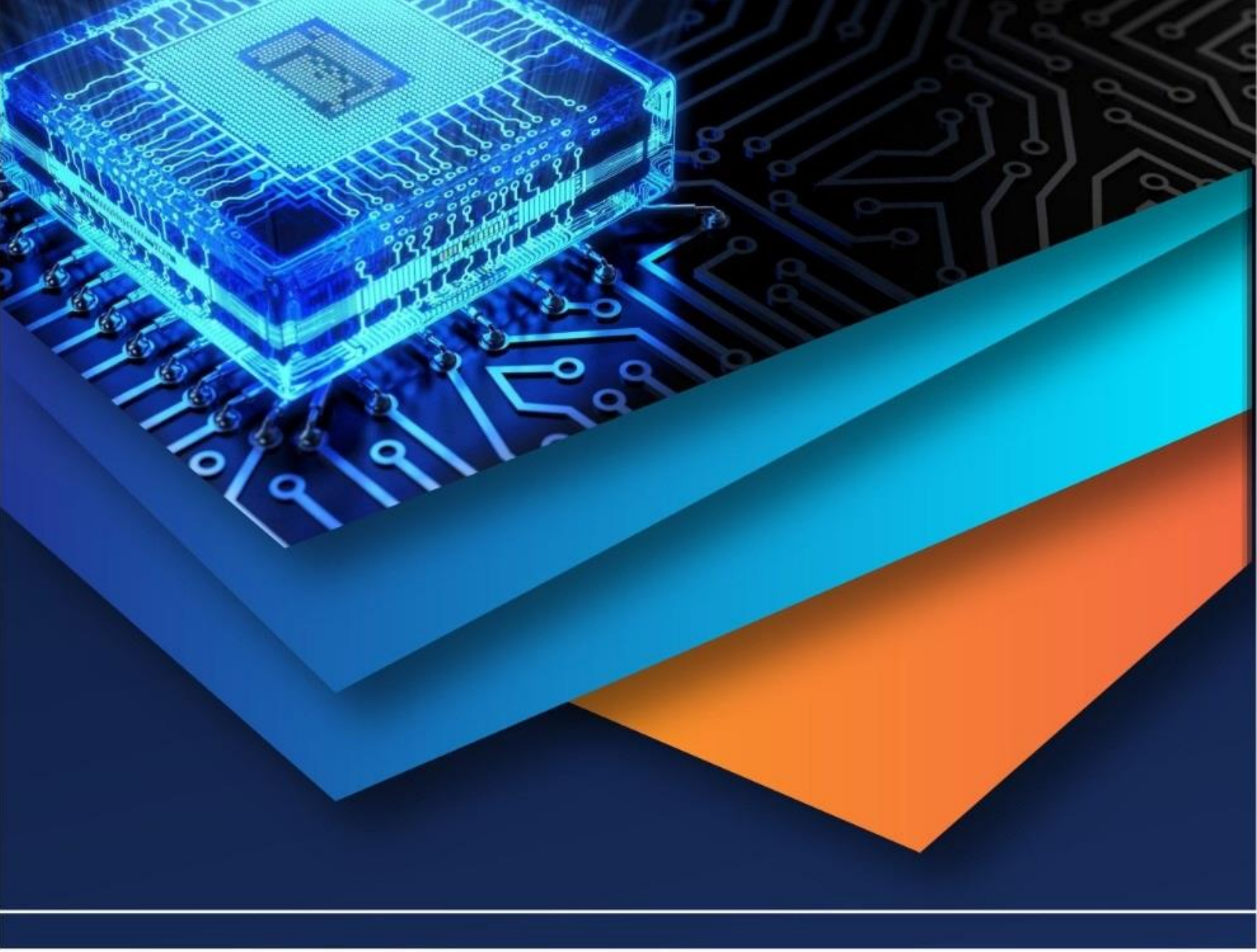

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