

A Comparative Study of Cloud Computing Platforms

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Abstract. This article offers a comparison and analysis of three of the most widely used cloud computing platforms: Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). The research focuses on the most important aspects of each platform, such as the virtual machines they offer, the storage choices they provide, the database services they provide, and the serverless computing capabilities they provide. In addition to this, the paper discusses issues like as cost, availability, security, and scalability, as well as some of the positives and negatives associated with using each platform. The literature review that is included in this paper highlights some of the most important findings from recent studies on cloud computing platforms. These findings include the widespread use of Amazon Web Services (AWS), the difficulties that are encountered by organisations in the management of cloud computing resources, and the significance of aspects such as reliability, security, and cost when selecting a cloud computing platform. This article's overarching objective is to offer businesses a comprehensive introduction to AWS, Microsoft Azure, and Google Cloud Platform (GCP), and to assist those businesses in making well-informed choices regarding which cloud platform is best suited to meet their requirements.

Keywords. Cloud computing, AWS, Microsoft Azure, GCP, Virtual machines, Storage Databases, Serverless computing, Pricing.

I. Introduction

In recent years, cloud computing has become an increasingly popular technology because it provides businesses with a method that is both flexible and scalable for managing their information technology infrastructure. The proliferation of cloud computing has led to the development of numerous cloud computing platforms, each of which possesses a set of capabilities and features that are distinct from the others. Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform are three of the cloud computing environments that are particularly well-known (GCP).

This article presents a comparative analysis of these three cloud computing platforms, with a particular emphasis on the primary characteristics, benefits, and drawbacks of each option. The investigation delves into a wide variety of subjects, some of which are virtual machines, storage options, database management systems, and serverless computing. In addition, we take into account important aspects such as cost, accessibility, safety, and scalability.

The paper includes a literature review that gives an overview of recent research on cloud computing platforms and highlights some of the most important findings and trends in this field. The review is included in this paper. This includes research on the popularity of various cloud computing platforms, the difficulties that organisations face in managing cloud computing resources, and the factors that organisations take into consideration when selecting a cloud computing platform.

This article's overarching objective is to offer businesses a thorough introduction to AWS, Microsoft Azure, and Google Cloud Platform (GCP), and to assist those businesses in making well-informed choices regarding which cloud computing platform is best suited to meet their requirements. We hope that the readers will gain a deeper understanding of the similarities and differences between these platforms as a result of our comparison and contrast of the features and capabilities of each of these platforms, and that this will assist them in selecting the platform that most closely meets the requirements that are unique to them.

II. Literature Review

In recent years, platforms for cloud computing have seen an increase in their level of popularity, and as a result, a number of research papers have been published on the subject. A literature review was carried out in order to investigate the major ideas and conclusions presented in these studies.

In the realm of cloud computing, security is consistently one of the most hotly debated concerns. According to research conducted by Almorsy et al. (2016), businesses who are considering moving their operations to the cloud should prioritise security. Protecting customer data is a priority for the majority of cloud service providers, which is why many of them provide security features like encryption and access control. Yet, a number of academics have brought to light a number of possible flaws in cloud security (Sharma and Singh, 2016). This underscores the necessity for enterprises to thoroughly analyse the security measures of cloud providers before to making a choice about using their services.

Performance is yet another crucial aspect to consider while talking about cloud computing. According to the findings of a study that was conducted by Armbrust and colleagues (2010), the performance of cloud platforms is affected by a number of different factors. Some of these factors include the magnitude and complexity of the workload, the architecture of the platform, and the geographic distribution of the data centres. The performance of cloud platforms has been proven to be able to be enhanced by the utilisation of virtualization (Jang et al., 2012) and load balancing strategies, according to the findings of additional study (Li et al., 2014).

The cost of using cloud services is another element that is essential for businesses to consider. According to the findings of recent studies, cloud service providers make available a number of different pricing models, such as pay-per-use, reserved, and spot instances (Khalid and Siddiqui, 2017). Several cloud service providers, such as Google Cloud Platform, have introduced cutting-edge pricing structures, such as invoicing on a per-second basis, to provide their customers more leeway in how they utilise their services (Venugopal et al., 2018).

The literature has also devoted some attention to discussing the user interface of cloud services. Researchers have brought attention to the need of cloud service providers providing user-friendly interfaces that are straightforward to browse and give an all-encompassing perspective of the cloud's resources (Wang et al., 2014). This issue has been solved by certain cloud providers, such as Microsoft Azure, which offers a user interface that is straightforward and easy to understand.

When picking a cloud provider, businesses need to give careful consideration to a number of essential aspects due to the fact that cloud computing is a complicated and multi-dimensional industry. There are several key factors that need to be taken into consideration, some of the most important of which are user interface, cost, performance, and security. To get a more all-encompassing comprehension of this matter, additional facets of cloud computing, such as compliance, dependability, and vendor lock-in, might be the focus of study conducted in the future.

Methodology	Key Findings
Systematic Review [12]	<ul style="list-style-type: none">- AWS is the most popular cloud computing platform.- Azure and GCP are growing in popularity.- Organizations choose cloud computing platforms based on factors such as cost, security, and scalability.
Survey [13]	<ul style="list-style-type: none">- Organizations face challenges in managing cloud computing resources.- AWS is the most popular cloud computing platform.- Organizations choose cloud computing platforms based on factors such as reliability, security, and cost.
Case Study [14]	<ul style="list-style-type: none">- Organizations should consider factors such as scalability, security, and availability when choosing a cloud computing platform.- AWS and Azure are the most commonly used cloud computing platforms.

Comparative Analysis [15]	<ul style="list-style-type: none">- AWS, Azure, and GCP offer similar features and functionality.- AWS has the most extensive range of services.- GCP has a more user-friendly interface.
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Table.1 Summarizing some of the key findings from a literature survey on cloud computing platforms

III. Comprehensive Analysis

Because of their ability to provide flexible, scalable, and cost-effective computing resources, cloud computing platforms have become an essential part of many organisations' IT infrastructure. Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform are three of the most popular cloud computing platforms (GCP). This section will provide a thorough examination of these three cloud computing platforms.

a. Amazon Web Services (AWS)

Amazon Web Services (AWS) is a cloud computing platform provided by Amazon. It was founded in 2006 and has since risen to the top of the cloud computing market. AWS provides a comprehensive set of cloud computing services, including compute, storage, databases, analytics, machine learning, and more. AWS's key features include the following:

EC2 stands for Elastic Compute Cloud. This is a web service that provides cloud-based resizable compute capacity. Users can use EC2 to create and launch virtual machines on demand, paying only for the capacity that they use.

S3 stands for Simple Storage Service, and it is a storage service that provides scalable object storage for data backup and archival.

Relational Database Service (RDS): This is a managed database service that supports a variety of database engines such as MySQL, PostgreSQL, Oracle, and Microsoft SQL Server.

Lambda is a serverless computing service that allows developers to run code without the need for server provisioning or management.

AWS offers a variety of pricing options, such as pay-as-you-go, reserved instances, and spot instances. It also offers a free tier that allows users to test out its services for free.

b. Microsoft Azure

Microsoft Azure is a cloud computing platform offered by Microsoft. It was first introduced in 2010 and has since grown to become one of the main cloud computing platforms. Azure provides a comprehensive set of cloud computing services, including computation, storage, databases, networking, analytics, and more. Azure's primary features include the following:

Virtual Machines: This is a cloud-based service that allows customers to construct and deploy virtual computers.

Blob Storage: This is a storage solution that delivers unstructured data with scalable object storage.

Azure SQL Database is a managed database service that supports SQL Server as well as other database engines.

Functions: This is a serverless computing solution that allows developers to run code without the requirement for servers to be provisioned or managed.

Azure has several pricing models, including pay-as-you-go, reserved instances, and spot instances. It also has a free tier where consumers may try out its services for free.

c. Google Cloud Platform (GCP) (GCP)

Google Cloud Platform (GCP) is Google's cloud computing platform. It was first introduced in 2011 and has since grown to become one of the main cloud computing platforms. GCP provides a comprehensive set of cloud computing services, including computation, storage, databases, networking, analytics, and more. GCP's primary characteristics include the following:

Compute Engine is a cloud-based service that allows customers to construct and deploy virtual computers.

Cloud storage is a type of storage that offers scalable object storage for unstructured data.

Cloud SQL is a managed database service that supports MySQL and PostgreSQL.

Cloud Functions: A serverless computing solution that allows developers to run code without the requirement for server provisioning or management.

GCP provides a variety of pricing options, such as pay-as-you-go, sustained usage discounts, and committed use savings. It also has a free tier where consumers may try out its services for free.

Finally, Amazon, Microsoft Azure, and Google Cloud Platform are among the most popular cloud computing systems. Each platform provides a diverse set of cloud computing services, such as computation, storage, databases, networking, and others. While each platform has its own set of features and price choices, they all have one thing in common:

Cloud Computing Platform	Key Features
AWS	<ul style="list-style-type: none">- Elastic Compute Cloud (EC2)- Simple Storage Service (S3)- Relational Database Service (RDS)- Lambda
Microsoft Azure	<ul style="list-style-type: none">- Virtual Machines- Blob Storage- Azure SQL Database- Functions
GCP	<ul style="list-style-type: none">- Compute Engine- Cloud Storage- Cloud SQL- Cloud Functions

Table.2 Comparing AWS, Microsoft Azure, and GCP based on their key features

IV. Comparative Analysis

Cloud computing platforms have grown in popularity in recent years, providing a wide range of services such as storage, computation, and data analytics. Nevertheless, with so many cloud providers to choose from, it can be difficult to select the right platform for a certain use case. We will compare three of the most popular cloud computing systems in this study: Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).

Pricing: Each of the three platforms has a variety of price choices, including pay-per-use, reserved instances, and spot instances. AWS is the most costly, whereas GCP is the least expensive. Nevertheless, price may differ based on the service or product being used.

Performance: All three systems provide excellent levels of scalability, dependability, and availability. AWS, on the other hand, has been the market leader in this space for many years, with a massive network of data centres and a wide choice of services.

Features: Each platform offers its own set of capabilities and services, with AWS providing the greatest functionality. Microsoft Azure excels in hybrid cloud and artificial intelligence/machine learning, whereas GCP is recognised for its strength in big data and analytics.

User Interface: The user interface for each platform varies substantially, with Amazon being the most sophisticated and challenging for newcomers to manage. Microsoft Azure has a more user-friendly UI, but GCP provides a more contemporary and simplified user experience.

Security: All three platforms have strong security safeguards in place, with AWS providing the most comprehensive security features and certifications. Microsoft Azure offers a solid security infrastructure as well, whereas GCP is recognised for using encryption and safe networking.

Support: Each platform provides varying levels of assistance, ranging from community forums to premium 24-hour support. AWS offers the greatest support community, while Microsoft Azure and Google Cloud Platform provide comparable levels of assistance.

Factor	AWS	Microsoft Azure	Google Cloud Platform
Pricing	Pay-as-you-go model	Pay-as-you-go model	Pay-as-you-go model
	Reserved instances	Reserved instances	Committed use discounts
	Spot instances	Spot instances	Sustained use discounts
Performance	Highly performant	Highly performant	Highly performant
	Scalable	Scalable	Scalable
	High availability	High availability	High availability
Features	Rich feature set	Rich feature set	Rich feature set
	Wide range of services	Wide range of services	Wide range of services
	Large ecosystem	Large ecosystem	Large ecosystem
User interface	Robust	Robust	User-friendly
	Steep learning curve	Steep learning curve	Easy to use
Security	Highly secure	Highly secure	Highly secure
	Compliance with regulations	Compliance with regulations	Compliance with regulations
Support	Extensive	Extensive	Good

Table.3 Comparative analysis of AWS, Microsoft Azure, and GCP

V. Conclusion

A comparison of the three most well-known cloud computing platforms—AWS, Microsoft Azure, and GCP—has been offered in this study. We have examined each platform's salient characteristics as well as some of its benefits and drawbacks. Our investigation has demonstrated that while Amazon, Azure, and GCP all provide comparable features and capabilities, each platform also has distinct advantages and disadvantages. The popularity of AWS, the difficulties businesses face in managing cloud computing resources, and the significance of factors like reliability, security, and cost when choosing a cloud computing platform are just a few of the key findings from recent studies on cloud computing platforms that were highlighted in our literature survey. While deciding which cloud computing platform best meets their goals, organisations should take into account these elements as well as others. In conclusion, Amazon, Azure, and GCP are all reliable cloud computing platforms, and whatever platform is eventually chosen will depend on the unique needs and demands of each firm. The comparative analysis and literature review presented in this paper are intended to assist companies in selecting the most appropriate platform for their needs.

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