Microsoft Azure vs. Amazon Cloud Services: A Comparative Analysis

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Abstract*—Cloud computing is the on-demand, pay-as-you-go distribution of computing resources like data storage, computing power, development tools and networking capabilities hosted at a remote data center which are distributed across multiple locations. These data centers are managed by various cloud service providers. It offers adaptable and expandable resources for quick access and development via mobile devices. Cloud computing is being used around the world by various organizations to boost their performance in the competitive environment. Cloud computing saw a great rise in recent technology trends across the globe. Choosing the best cloud service provider in the market can be a difficult process as each service provider has its own benefit and service quality. The tech giants like Amazon, Google and Microsoft are the leading cloud service providers with their own cloud network across the globe in the form of Amazon AWS, Google Cloud and Microsoft Azure. In this paper we would be comparing Amazon AWS and Microsoft Azure which could help in deciding which cloud service provider would provide optimum benefits according to the needs of the user.

***Indexed Terms*— Cloud Computing, Azure, Aws, Cloud Service, Comparison, Benefits**

I. INTRODUCTION

What is Cloud Computing: A cloud is a particular kind of parallel and distributed system made up of a number of networked, virtualized, and dynamically provisioned computer which is based on service-level agreements negotiated between the service provider and clients, and displayed as one or more unified computing resources.

A comprehensive solution that offers IT as a service is cloud computing. Multiple applications use the pooled computing capabilities of the cloud's linked machines to work as if they were all running on the same system.

Why Cloud Computing is so Important: Cloud computing has become an essential component in the development of a product or providing a service. It has elated the performance of teams and shortened the time of the deliverables to the end-user. There are quite a few reasons why cloud computing is such an important component of the development lifecycle of a product/service.

Few to mention-

- *Cost Savings:* All the infrastructure cost vanishes once switched to cloud computing.
- *Security*: A cloud host's full-time job is to carefully monitor security, which is significantly more efficient than a conventional in-house system, where an organization must split its resources among a plethora of IT challenges, security being only one of them.
- *Flexibility*: You don't have to worry about the storage issues and compute power if you can scale your solutions as per need which is quite possible due to cloud computing.
- *Mobility*: Cloud computing enables smartphone and device access to business data.
- *Insight*: With your information stored in the cloud, you can easily implement tracking mechanisms and build customized reports to analyze information organization wide which gives you quite good insights of what is going under the hood.
- *Increased Collaboration*: Collaboration is made easy when working with cloud computing. Team

members may securely share information over a cloud-based platform

- *Quality Control:* All papers are kept in a single location and in the same format in a cloud-based system. You can ensure data consistency, prevent human error, and retain a clear record of any changes or updates when everyone has access to the same data.
- *Disaster Recovery*: There are always going to be things that are absolutely out of your control, regardless of how in control your organization may be when it comes to its own procedures, and in today's market, even a small bit of useless downtime can have a resoundingly bad impact.
- *Loss Prevention*: All of your important data is inextricably linked to the workplace PCs it lives in if your company doesn't invest in a cloud computing solution. Even while it might not seem like a concern, if your local hardware has a problem, you risk permanently losing your data.
- *Automatic Software Updates:* Cloud-based applications automatically refresh and update themselves, instead of forcing an IT department to perform a manual organization wide update.
- *Competitive Edge*: Even if cloud computing is becoming more and more popular, some people still want localization. Although they have the option, doing so puts them at a major disadvantage when they compete with others who have access to the benefits of the cloud.
- *Sustainability*: Solutions to wastefulness at every level of a corporation are needed for sustainability. Hosting applications on cloud is a robust and environment friendly solution which has a very low carbon footprint.

Below is a diagram of the major cloud providers in the race.

2020 Magic Quadrant for Cloud Infrastructure as a Service, Worldwide (Image source: Gartner)

II. FEATURES AND SERVICES

The decision between these two will depend on the preferences and requirements of each client as well as the workloads they are managing. Organizations occasionally employ both suppliers in different areas of their operations and for various situations.

Perhaps there are differentiating characteristics between the two organizations' approaches that can assist users choose which is best for them. It is crucial to consider the services that the two companies provide. Similar features in terms of computation, storage, and networking are provided by both AWS and Azure.

Both of them utilize self-service and rapid provisioning, autoscaling, and security features found in public clouds. a few managerial services, too. Additionally, both businesses are spending to match the need for fresh cloud services. These have increased the sophistication of analytics services.

III. AMAZON AWS

AWS (Amazon Web Services) is Amazon's comprehensive, developing cloud computing platform that comprises a combination of infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and packaged-software-as-a-service (SaaS) solutions.

AWS offers its account holders on-demand IT services on a pay-as-you-go basis with no upfront investment. Enterprises utilize AWS to avoid the capital investment of establishing their own private IT infrastructure (which can be costly depending on the size and type of the organization). AWS has its own physical fibre network, which connects Availability zones, regions, and Edge sites. All maintenance costs are also borne by AWS, saving businesses a lot. Amazon Web Services provides flexibility because you only pay for the services you use or require.

What are the services provided by Amazon AWS?

1. Computing Services

a. Amazon EC2:
Amazon Elastic Computation Cloud (Amazon EC2) is a cloud computing online service that provides safe, scalable compute power. It enables enterprises to purchase and customise cloud-based virtual computing resources. You may choose from a range of operating systems and resource settings for your application, such as RAM, CPU, and storage. Amazon EC2 allows you to expand or reduce capacity in seconds. You can run one, hundreds, or even thousands of server instances at the same time.

b. Amazon Lambda:
AWS Lambda is a serverless, event-driven computation solution that enables you to run code without the need for server management. You just pay for the compute time you use, and there are no fees while your code is not executing. AWS Lambda allows you to run code for any form of application with no management. Simply upload your code, and Lambda will handle everything needed to execute and grow it with high availability.

2. Storage Services

a. Amazon S3 (Simple Storage Service):
Amazon Web Services offers a web service interface-based object storage solution in the form of Amazon S3 or simple storage service. Amazon S3 handles data using an object storage architecture that strives for scalability, high availability, low latency, and high durability. Amazon S3's fundamental storage units are items arranged into buckets. A unique, user-assigned key identifies each object.

3. Database Services

a. Amazon RDS (Relational Database Service):
The Amazon Relational Database Service (Amazon RDS) is a suite of managed services that makes it easy to set up, run, and grow databases in the cloud. Amazon RDS (Amazon Relational Database Service) makes it simple to set up, run, and grow relational databases in the cloud. It offers scalable and cost-effective capabilities while automating time-consuming administrative activities including hardware provisioning, database setup, patching, and backup. The Amazon Relational Database Service (Amazon RDS) is a suite of managed services that makes it easy to set up, run, and grow databases in the cloud. Amazon RDS (Amazon Relational Database Service) makes it simple to set up, run, and grow relational databases in the cloud. It offers scalable and cost-effective capabilities while automating time-consuming administrative activities including hardware provisioning, database setup, patching, and backup.

b. Amazon DynamoDB (Non-Relational Database)

Amazon DynamoDB is a high-performance and adaptable NoSQL database solution for any applications that require reliable, single-digit millisecond latency at any size. It is a fully managed database that can handle both document and key-value data.

IV. MICROSOFT AZURE

Microsoft Azure, sometimes known as Azure, is a cloud computing platform run by Microsoft that allows for application administration via Microsoft-managed data centers.

Microsoft Azure provides broad support for a variety of programming languages, tools, and frameworks which may include Microsoft-specific and third-party software and systems. It offers software as a service

(SaaS), platform as a service (PaaS), along with infrastructure as a service (IaaS).

What are the services provided by Microsoft Azure?

1. *Computing Services*:

a. Azure Functions: Azure Functions is a serverless solution that lets you write less code, manage less infrastructure, and save money. An on-demand cloud solution called Azure Functions provides all the resources and infrastructure that are always up to date in order to run your applications. Instead of having to worry about establishing and managing servers, the cloud architecture delivers all of the current resources required to keep your apps functioning.

2. *Storage Services*:

a. Azure Storage: Azure Blob storage in the cloud enables scalable, cost-effective object storage. For your most demanding tasks, store and access unstructured data. Blob storage is designed to hold large amounts of unstructured data, such as text or binary data.

3. *Database Services*:

a. Azure SQL: Azure SQL Database is a relational database management system (RDBMS) service supplied by Microsoft Azure that is extensively utilised by developers for developing new cloud-based apps. It is a highly scalable platform-as-a-service (PaaS) created specifically for cloud applications that is totally managed by Microsoft. In this section, we will establish a managed database server in the cloud and utilise it to deploy our database.

b. *Azure Cosmos DB*: Azure Cosmos DB is a NoSQL and relational database that is fully managed for modern app development. Cosmos DB internally stores "things" in "containers," with these two notions of displayed differently depending on the API used. Containers are organized into "databases," which are similar to the namespaces above containers. Containers are schema-agnostic, which implies that while adding objects, no schema is

Sr. No	Amazon AWS	Microsoft Azure
1.	DynamoDB	Cosmos DB
2.	Amazon S3	Azure Blob
3.	Amazon EC2	Azure Virtual Machines
4.	Amazon RDS	Azure SQL Server

V. ADVANTAGES

S3 and EC2 are two of the most crucial services offered by Amazon Web Services, and here we compare them with Azure.

are providers of comparable services.

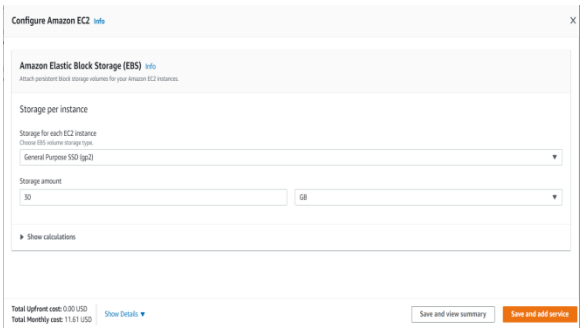

Image src: AWS Console

- ADVANTAGES OF AMAZON EC2 (Elastic Cloud Compute):

a. At least initially, EC2 is less expensive. One can obtain an instance running EC2 Linux Server for roughly $12 per month.

b. EC2 is well-known. The benefit of EC2 is that it functions as your own Linux Server without requiring you to purchase any hardware. The notion of EC2 is straightforward, which is one of its greatest advantages. Anyone who has never utilized virtual software will be able to quickly use what it does.

VI. ADVANTAGES OF MICROSOFT WINDOWS AZURE

1. EC2 is more expensive than Azure. Azure requires virtually no upkeep. Microsoft will

manage your software; all you have to do is implement your application.
2. Additionally, Amazon EC2 costs more to maintain than Azure. Cost is a problem, and it's difficult to estimate.
3. Linux Azure has high scalability. This application has several opportunities to have many. The amount of data consumed by users is enormous. If these requirements are met, Linux Azure is as straightforward as modifying a value.

VII. KEY DIFFERENCES BETWEEN MICROSOFT AZURE AND AMAZON AWS

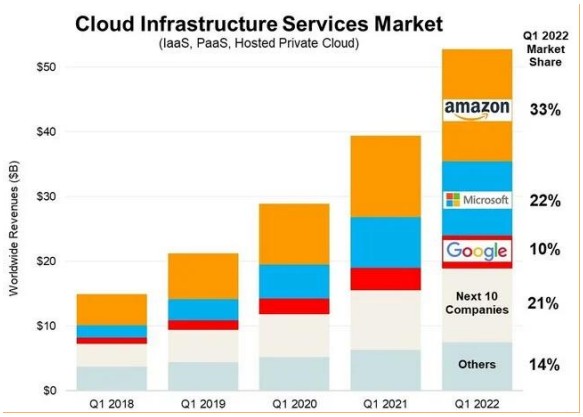

Image src: Synergy Research Group

1. Strategies for computing power

Scalability is the key factor for computing power. With respect to scalability, AWS uses Elastic Cloud Computing (EC2), which allows changes in resource footprint as per demand. The primary difference is that EC2 may be tailored for specific purposes, whereas Azure VMs operate in combination with other cloud-deployment technologies. EC2 customers may build their own virtual machines (VMs), use pre-configured machine images (MIs), or alter MIs, and adjust the power, size, and memory of the VMs necessary. They can also specify the number of virtual machines required. Azure users, on the other hand, have the option of constructing a VM from a virtual hard disc (VHD).

2. Cloud Storage Management

Having adequate storage at a reasonable price is the deciding factor while buying cloud services. Both Amazon AWS and Microsoft Azure have an equal share regarding this aspect. AWS provides us with simple storage service (S3), elastic block store (EBS), and Glacier, whereas Azure Storage Services provides blob storage, disc storage, and standard archive.

3. Data Security

AWS does a good job of picking secure alternatives and default settings to provide increased privacy. Azure relies on Microsoft's Cloud Defender service for security and data privacy, which is driven by artificial intelligence and safeguards against new and existing threats.

4. Pricing Model

AWS and Azure both provide fair pricing and a pay-as-you-go pricing mechanism. Furthermore, both provide complimentary starting packages to show consumers how their systems may be linked with on-premise applications. AWS charges on an hourly basis. Meanwhile, Azure is priced on a per-minute basis, giving consumers a more precise pricing component than AWS. You may also input short-term commitments to select between prepaid and monthly costs.

VIII. WHICH CLOUD SERVICE TO CHOOSE?

1. CHOOSE AMAZON WEB SERVICES IF YOU REQUIRE:
   a. Efficient scalability and automation offerings
   b. Locally and globally available
   c. A robust application
   d. The most reliable feature set
   e. Various levels of security

2. CHOOSE MICROSOFT AZURE IF YOU ARE:
   a. Invested in Microsoft
   b. Accepting scalability limitations
   c. Using Azure PaaS or Office 365
   d. Wishing to work with only one provider
   e. Needing other plan for AWS
   f. Benefiting by using it financially.

CONCLUSION

Cloud computing is based on the need for access to virtualized IT resources that are stored away from your location. You can share these resources with

other services and still use them easily. In addition, you can subscribe to this service for a low monthly fee and use the web's many features with ease. The provider of cloud services

provides cloud computing services like Platform as a Service (PaaS), Storage as a Service (SaaS), and Infrastructure as a Service (IaaS), among others. Amazon and Azure are the two most popular cloud service providers at the moment. In this essay, we compare the two options by listing their features, services, advantages, and disadvantages.

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