

COMPARATIVE STUDY OF CLOUD PLATFORMS - MICROSOFT AZURE, GOOGLE CLOUD PLATFORM AND AMAZON EC2

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Abstract—Any application or resource that is made available to the users via an internet connection from a cloud platform is known as a cloud-based service. Any IT organization is highly dependent on its cloud architecture & platform planning that specifically caters to the needs of that specific organization.

This paper work mainly focuses on top three cloud platforms that you can use to effectively manage the IT needs of your organization, namely Amazon Elastic Compute (AWS), Google Cloud Platform, and Microsoft Azure. All three of these major competitors in this field have their own merits which help them survive in this harsh competition.

Paper work starts by a brief introduction of cloud computing followed by 3 main cloud platform architectures. Furthermore, we have shown comparative analysis of these platforms on different aspects like pricing, specification, support and administration, database, ML and AI support, storage, deployment tools, networking and security. This study will help the cloud user to select the best cloud platform for their respective purposes.

Keywords—*platform, security, administration*

I. INTRODUCTION

DEFINITION OF CLOUD COMPUTING

The convenient, ever-available & on demand access to a set of configurable resources used for computing like storage & virtual machines that can easily managed via an interface is defined as the cloud computing model.[1]

ADVANTAGES OF CLOUD COMPUTING

There are many benefits to cloud computing such as providing cost saving & secure solutions to the user along with providing him flexibility over data & recovery in cases of disasters. It is the job of the cloud platform to manage an application using some quality control mechanisms while increasing the collaborative ability of multiple groups of people. [2]

II. DIFFERENT TYPES OF CLOUD COMPUTING DEPLOYMENT MODELS

There are various deployment models which hae many servers to enable fast access to the data

III. CLOUD COMPUTING SERVICE MODEL

The models can be classified as follows:

A)Private Cloud

Private clouds are majorly used by stand-alone organizations which are perfect for high-security requirements.

B)Public Cloud

Public clouds are majorly used in networks and are perfect for growing organizations. It can holster the needs for both small scale & large-scale businesses.

C)Community Cloud

Community cloud is used by joint organizations to share data effectively. These are very useful to organizations such as banks.

D) Hybrid Cloud

The amalgamation of private & public clouds into one system is known as hybrid cloud. It is really helpful for organizations whose requirements are both. It helps them to privately interact within the organization & publicly interact with customers using public cloud

Table 3.1Cloud service models

Cloud Service models [3]			
Parameters	IAAS	SAAS	PAAS
Defination	The outsourcing of instructure such as virtual machines or storage is known as providing Infrastructure as a Service.	The model to host softwares on a cloud platform to avoid unnecessary installation is known as providing Software as a Service.	Providing a runtime environment for users to easily deploy web applications on a pay-per-use basis is known as Platform as a Service.
Advantages	Allows creation of remote servers. Provides a set of APIs’ to manage everything.	Used to provide entire solutions such as ERP implementation. No excess installs are required.	Easy to use Companies use it to host and spread web applications easily
Disadvantages	This model is not very flexible and the maintainance is very demanding.	This model makes it such that the user is very constrained to the software that is provided and cannot do much more than that.	This model is very vendor dependent and sometimes may conflict with the existing infrastructure of the consumer company.

IV. INTRODUCTION TO CLOUD PLATFORMS

A. AMAZON EC2

The Amazon web services have been operating since 2006 providing services in the fields such as: [4][5][6]

- Compute
- Storage and content delivery
- database
- Networking

The Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity to eliminate the investments in the hardware for faster deployment. Multiple virtual servers can be created and managed through the use of Amazon EC2 hence making the usage very scalable.[7]

There are many features that are provided by Amazon EC2 such as instances, AMIs’, authentication, storage solutions, firewalls & many more.

B. GOOGLE CLOUD PLATFORM

The Google Cloud Platform was started in 2011 and since its beginning, it has accumulated many important partners such as Airbus, Coca-Cola, HTC, Spotify, etc. most notably Equinix, Intel and Red Hat. [8][9][10]

Google Cloud Platform also offers storage options such as:

- MySQL Database
- Cloud Datastore
- Cloud Storage

Each of the above-mentioned storages are available at separate pricing slabs calculated in the units of GB per month.

The services provided by Google Cloud Platform are:

- Compute

- Storage and Databases
- Networking
- Big Data
- Machine Learning
- Management Tools
- Developer Tools
- Identity & Security

C. MICROSOFT AZURE

The Microsoft Azure is a public cloud platform that allows the user to build & deploy web applications while storing the data in the Microsoft Datacenters.

The services provided can be categorized as follows:

- Cloud Applications
- Data Management
- Networking
- Identity & access control
- Messaging & integration [11]

The azure platform supports development in many languages and can integrate applications from cloud into pre-existing IT environments. [12][13][14][15][16]

Windows Azure provides the organizations a facility to have single authentication with synchronized data present at headquarters. The system also provides the ability to generate security reports at any given time. Several different methods of authentication can be used to prevent unauthorized access of data. The users are also allowed to implement roles, level of authorization & permissions. [13][17]

V. COMPARING THE CLOUD PLATFORMS

TABLE 2: Comparing the three cloud platforms on various parameters as mentioned below. [11][18][19][20][21][22][23]

COMPARISON BETWEEN AMAZON EC2, GOOGLE CLOUD PLATFORM & MICROSOFT AZURE [11][18][19] [20][21][22][23]			
Parameters	Amazon EC2	Google Cloud Platform	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
Databases & virtualization			
Databases	<ol style="list-style-type: none"> 1. MySql 2. PostgreSQL 3. MariaDB 4. MongoDB 5. Redis 6. Memcached 	<ol style="list-style-type: none"> 1. Cloud SQL 2. Cloud Spanner 3. Cloud Bigtable 4. Cloud Firestore 5. Firebase Realtime Database 6. Cloud Memorystore 	<ol style="list-style-type: none"> 1. Azure SQL
Virtual machines types	<ol style="list-style-type: none"> 1. General purpose 2. Compute Optimized 3. Memory optimized 4. storage optimize 5. Accelerated computing 	<ol style="list-style-type: none"> 1. Standard machines 2. High-memory machines 3. High-CPU machines 4. Mega-memory Machines 	<ol style="list-style-type: none"> 1. General purpose 2. Compute Optimized 3. Memory optimized 4. storage optimize 5. High Performance compute
Virtualization Technology	XEN Virtualization Technology	KVM Hypervisor Virtualization technology	Hyper-V Hypervisor Virtualization technology
Pricing			
Pricing types	On-Demand, per-second billing	Pay as you go, on-demand per second billing	Pay as you go pricing
Specifications			
Server OS types	Linux, Windows	Linux, Windows	Linux, Windows
Pre-configured OS	<ol style="list-style-type: none"> 1. Amazon Linux 2. Cent OS 3. Debian 4. Oracle Linux 5. Red Hat Linux 6. Ubuntu 7. Windows Server 	<ol style="list-style-type: none"> 1. Cent OS 2. Debian 3. Ubuntu 4. Red Hat Linux 5. Windows Server 	<ol style="list-style-type: none"> 1. Cent OS 2. FreeBSD 3. OpenSUSE Linux 4. Oracle Linux 5. Ubuntu 6. Windows server
Available runtimes	<ol style="list-style-type: none"> 1. .NET 2. JAVA 3. PHP 4. Python 5. Ruby 	<ol style="list-style-type: none"> 1. Python 2. JAVA 3. Node 4. PHP 5. Ruby 6. GO 	<ol style="list-style-type: none"> 1. .NET 2. JAVA 3. Node 4. PHP 5. Python 6. Ruby
Machine Learning Frameworks Supported	<ol style="list-style-type: none"> 1. Apache 2. MXNet (With Gluon API) 3. TensorFlow 4. Caffe framework 	<ol style="list-style-type: none"> 1. TensorFlow 2. DistBelief 3. Many in-built API's to support development 	<ol style="list-style-type: none"> 1. PyTorch 2. TensorFlow 3. Scikit-learn 4. MXNet 5. Chainer 6. Keras
Support & Administration			

Support available	24/7, Forums, self-help resources, documentation	Responses takes minimum of 15 mins (with top tier pricing) & upwards of 1 day, telephonic communications, forums, training, documentations	24/7, forums, live chats, telephonic communications, documentation
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The data in the above table has been studied and compared by referring the following citations: [11][18][19][20][21][22][23]

VI. ANALYSIS OF THE COMPARISON

This paper concentrates on comparing the three major cloud service providing platforms i.e. Amazon EC2, Google Cloud Platform & Microsoft Azure. The paper begins with a brief introduction to the three major players in the field & then compares the similarities & differences between the three of them.

The analysis of the above comparisons show the following results which are categorized below:

- **General:**
 - Microsoft Azure is the most widespread cloud platform out of the three.
 - Google cloud platform provides a direct IDE support namely Cloud9.
 - Amazon EC2 is the oldest of the three with a firm grasp on IaaS service model.
- **Database & Virtualization:**
 - Azure provides the least amount of database options while Google cloud platform provides the most.
 - Amazon EC2 provides the most number of virtualization options.
- **Pricing:**
 - All three have customer specific pricing schemes that depend on the usage.
- **Specifications:**
 - While Microsoft Azure provides the highest number of ML framework support, Amazon EC2 has the highest number of pre-configured OS.

- Google cloud platform boasts the highest number of runtimes.

- **Support:**

- All the three platforms provide a great deal of support in the form of forums & documentations.

VII. CONCLUSION

With the emergence of new start-ups everyday & the high consumption of data by the users on a daily basis, the need for high speed data processing & large-scale storage solutions are very necessary. The solution for these problems is provided by the cloud platforms through virtualization i.e. creating many virtual machines on a single physical machine. This results in high processor efficiency & less idle time for the processor.

The three cloud platforms compared above have their own merits which makes them good in their own respective ways. While the Amazon EC2 is the oldest & has the support for maximum number of pre-configured operating systems, it lacks in its reach & support availability. Similarly, the Google Cloud Platform support the maximum number of databases & have a great repository of in-built libraries, it lacks in SDK support & has a pay-to-help model which changes the support delay according to the tier of service availed. The Microsoft Azure platform has the highest reach out of all the three but lacks severely in database supports.

Hence, we conclude that the selection of the cloud platform is highly dependent on the requirements of the user which change user to user. Careful analysis of the requirements is advised before selecting the platform.

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